RADICAL SURGERY IN ADVANCED ABDOMINAL CANCER

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TO MY

RESIDENTS AND INTERNES

PAST AND PRESENT

GRATEFULLY ACKNOWLEDGING THEIR LABORS

IN CONTRIBUTION TO THIS STUDY

AND TO

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FOREWORD

OPERATIVE surgery was thought to have reached its full development some years ago by which time most of the organs and tissues of the body had been subjected to successful surgical attack. In recent years the central nervous system, the contents of the thoracic cavity, and the pancreas have been brought within the scope of "current surgery." Modern research on shock, with the developments in prophylaxis and treatment, the advent of vitamin K, the introduction of continuous spinal anesthesia, the knowledge of fluid balance, a greater appreciation of nutrition for surgical patients, and the advent of chemotherapy with the sulphonamides and penicillin have contributed to the reduction in risk attendant upon a major surgical procedure. This must lead to a modification of previous concepts of "operability." The question as concerns advanced intra-abdominal malignant neoplasms is the subject of this essay.

The patients referred to in the following text were all hospitalized in the University of Chicago Clinics and the operations were performed by the author. They represent a series of unselected cases in which "standard" concepts as to operability of intra-abdominal cancer were purposely disregarded. The decision to proceed with excision was governed entirely by the findings which showed whether or not all macroscopic tumor could be removed, regardless of location, type of neoplasm, and extent of involvement. Where excision of the primary growth could be carried out but liver and other metastases were present and would remain, the justification for the operation was the feeling that palliation might be afforded by the procedure when it could not be afforded by other means available. The principal objective of this investigation is to permit of some impressions as to what might be accomplished by radical extension of operative surgery for the "inoperable." A corollary to this study was the development of several radical operations such as gastrecto-spleno-pancreato-colectomy, total gastrecto-total pancreatectomy-splenectomy, colecto-pancreato-splenectomy, etc. Limiting the discussion to the endeavors of a single operator permits of the control of such factors as surgical judgment, manual dexterity, finer points in technique, etc. A study of this type in a significant series of patients has not been previously recorded.

The writer desires to express his great appreciation to Dr Dallas B Phemister for his interest and support of the project Indeed these studies were a natural outgrowth of Dr Phemister's contributions to the nature, prevention, and treatment of shock The author is deeply grateful to Dr George F Dick for sustained encouragement at all times To his colleagues in the departments of Surgery, Medicine, and Obstetrics and Gynecology the writer expresses his gratitude for their co operation which greatly expedited these studies It is also a pleasant duty to express profound gratitude to Mr R T Miller Jr, who established the O C Miller Fund for Cancer Research and the O C Miller Radium Clinic in the University of Chicago A grant from the O C *Miller Fund facilitated* the preparation of the manuscript for this volume and provided for the artist s drawings and photographs

ALEXANDER BRUNSCHWIG M D

UNIVERSITY OF CHICAGO CLINICS

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[1] A number of other patients are also cited in connection with discussion of various subjects but treatise serial case numbers have not been assigned to them inasmuch as they did not receive massive resection for carcinoma.

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CHAPTER I

HISTORICAL

In the history of science as in that of any expression of human intelligence and emotion the past is never past but continues and is very active in every form and at every manifestation of the present — ARTURO CASTIGLIONI

CANCER in various forms is mentioned in the earliest medical writings but obviously little could be said concerning its treatment It was implied that once the diagnosis was made treatment was of little avail Celsus stated that cancer occurs in the female breast on the face and in the internal organs and that it commences by the formation of a kakroethos later becoming a carcinoma and eventually ulcerating None of these can be removed except the kakroethos ' the rest are aggravated by every method of treatment and the more energetic the remedies the more irritable they become None were ever treated successfully with medicine After excision though a cicatrix has been formed they have returned again and carried off the patient But no one can distinguish a kakroethos which is curable from a carcinoma which is incurable except by time and experiment (Leonardo)

Until the advent of modern abdominal surgery following the introduction of anesthesia and asepsis surgeons were concerned with superficial malignant neoplasms Cancer of the breast was treated palliatively by mastectomy and cutaneous cancers were cauterized in an attempt to restrain their progress and reduce wound discharges and odors Malignant growths of the superficial orifices were treated in a like manner Amputations for malignant growths on the extremities were also performed for palliative purposes The surgeons of the preantiseptic era were especially concerned with making a correct diagnosis of cancer in order to avoid performing curative operations for it—operations which would be doomed to failure with unfortunate reflections upon the abilities of the surgeon For example John of Arderne (1307–80) wrote concerning rectal cancer

Explore carefully with the finger at any rate and do not be led away and offer to operate It will be only a disgrace to you Warn the friends of the certain ending On the other hand Giovanni Battista Morgagni (1682–1771) anticipated the present position of surgery with regard to the treat-

ment of cancer He advised the operative removal of these malignant tumors whenever possible not with the idea that the disease could be always thus completely cured but because early operation gave speediest relief of annoying symptoms and assured the greatest prolongation of life Morgagni pointed out that the quickest the safest the surest and in the end for the patient the easiest method of removal is by the knife in the hands of the bold and skillful surgeon' (Leonardo)

Improved results in the treatment of intra abdominal cancer have of course followed general improvements in surgical procedures Progress has been relatively slow but over the years great advances have been achieved Following the introduction of anesthesia and two decades later, antisepsis and finally asepsis, the problems concerned with the removal of various organs had to be resolved The difficulties in the early modern era aside from the questions posed by the operations themselves included preoperative clinical diagnoses without the aid of roentgenography, the general reluctance on the part of patients to submit to laparotomy the question of shock lack of blood transfusions, the onus of general high surgical mortality etc It is not surprising, therefore that progress was at first slow and that in the beginning resections of intra abdominal malignant neoplasms were relatively restricted

The modern surgery of intra abdominal cancer owes its development to the labors of many surgeons of different nationalities working in various localities and at different periods It is not possible to cite specifically the first instances of successful abdominal operations They were performed before the days of anesthesia and asepsis The feats of these first pioneers are of historic interest only since they represent isolated achievements that did not influence the course and progress of surgery For example Caesarean section is an old procedure dating from ancient times and yet its general applicability was not possible until the advent of anesthesia and asepsis Castiglioni states that Zaccarelli in 1549 and Zambeccari in 1680 performed successful splenectomies yet from the practical viewpoint such remarkable feats exerted little influence upon the evolution of surgery However it must be acknowledged that if the technical progress of abdominal surgery was possible only after the advent of anesthesia and asepsis some of the present day principles of abdominal surgery had their origins in the contributions of surgeons in the era just preceding anesthesia and asepsis

What might be termed the first successful elective laparotomy was

performed in 1809 by Ephraim McDowell of Danville, Kentucky, for removal of a large ovarian cyst. However, it was not until 1817 that he reported this case together with two other cases. Possibly laparotomy was performed prior to this time, but it is McDowell's reports that mark the beginning of the continuous story coming down to the present time, and therefore the credit for demonstrating the feasibility of laparotomy must be accorded him. John Lizars, having received McDowell's reports addressed to John Bell, who died before they reached him, became the propagator of ovariotomy in England (1825). In the United States, Nathan Smith performed independently a successful ovariotomy in 1821 (Norwich, Vermont) not knowing of McDowell's work. Later the Atlees of Pennsylvania did much to popularize the operation in this country. It was not until 1864 that Jules Pean performed the first ovariotomy in Paris, and it was not performed in Germany until about the same time (Koeberle).

The contributions of Dupuytren and especially Lembert should be regarded as a great milestone in the development of modern intestinal surgery. In order to obliterate the colostomy resulting from resection of the sac and its contents in the treatment of strangulated herniae, Dupuytren devised an enterotome, which resembled a pair of long bladed scissors. Each blade was inserted into a loop of bowel and then approximated by a screw in the handle. This crushed together both loops with resultant necrosis of the walls separating their lumina and led to the passage of fecal material down the bowel, so that the external fistula became smaller and could be closed eventually. He reported 41 cases treated in this manner with only 3 deaths (1828). The principle illustrated by this procedure was the adherence of the serosae of surgically approximated loops of bowel with fistulization between them as a result of pressure. Still greater progress may be ascribed to Lembert, Dupuytren's pupil, to whom the latter did not give sufficient recognition. Lembert, perceiving the above principle, described a principle of bowel suture that was the direct forerunner of successful bowel resections with anastomosis. His principle was the suture of intestinal wounds by passing the thread through serosa and muscularis of one edge and serosa and muscularis of the other edge, so that when it was drawn tightly, serosa of one edge was apposed to serosa of the other, with inversion of the mucosal borders; this resulted in inflammatory sealing of the wound. This study was reported in 1826, and Lembert gave credit to Dupuytren for originating the principle and

prophetically stated 'This method is equally applicable to all solutions of continuity of the intestines and even to the stomach, its technique will be the same though it may assume a different form (Zachary Cope) Ironically Lembert himself did not report a successful case but his labors were not unheeded at the time since Dieffenbach in 1836 published the account of the first successful bowel resection with end to end anastomosis (for gangrene in strangulated hernia), giving credit for the method of suture to Lembert He wrote Then I sutured the ends of the intestines by a *special suture the stitch was first* inserted two lines from the free edge and always carried transversely across the gap so that the suture placed in the muscular layer brought together only the peritoneal surfaces in accordance with the teaching of Lambert [Lembert] The mucosa was not sutured but its edges were inverted all the way around' (Zachary Cope)

Colostomy which is a very frequent procedure in palliative operations *of inoperable carcinoma of the colon, was first suggested by Littre in* 1710 after he had observed the necropsy of an infant with congenital absence of a segment of rectum the upper obstructed loop being filled with meconium The first actual opening of the colon above an obstructing carcinoma was successfully performed by Pillore a surgeon of Rouen in 1776, and the second successful procedure of this type performed on the transverse colon was reported by Fine in 1797 *Amussat s monograph* published in 1839 is the first extensive study of colostomy He advocated the lumbar route in order to avoid entering the peritoneal cavity His work established this as the usual procedure until it was superseded by the abdominal approach during the last two decades of the nineteenth century *Excision of malignant neoplasms of the rectum by the perineal route* was reported by Lisfranc in 1833 *there were three fatalities among nine* cases

Sedillot performed gastrostomy in 1849 but the patient died later Sedillot developed a successful two stage method Küchler in 1855 and Spencer Wells in 1868 revived splenectomy Gustav Simon is credited with the first nephrectomy in 1869

The combination of anesthesia (1842 Long 1846 Morton) and antisepsis (1869 Lister) with asepsis in 1885 (Von Bergman) ushered in the Golden Age for rapid and spectacular advances in abdominal surgery Billroth in 1876 excised the cancerous cecum Surmay (Ham) performed the first jejunostomy for palliation in a patient *with gastric cancer* in

scribe the operation (1892) The modern methods of combined abdomino perineal resections were due to the work of Quenu Hartmann, Konig and Ernest Miles at the end of the last and the early part of the present century

The pendulum swings first in one direction and then in another Following the initial steps of certain bold operators in the early era of aseptic surgery operative procedures became more or less standardized and greater attention was focused upon methods for reduction of mortality and morbidity and on the finer points in technique and in the development of anesthesia The general impression developed that advances in surgery would henceforth stem from laboratory research especially in physiology and biochemistry Rene Leriche stated in 1930 that the surgery of the future would be characterized by minimal operative procedures with maximal physiologic effects This certainly applies to the surgery of the endocrine glands and certain phases of neurosurgery However after the second and third decades of this century, operative surgery again received great impetus from the development of the surgery of the central nervous system of the thoracic viscera of the cardioesophageal region and of the ampullary region and pancreas *These advances were stimulated for the most part by the problems presented by malignant neoplasms in these regions* No better evidence of the remarkable advances in operative surgery can be afforded than the fact that resident surgeons in the teaching centers now perform operations which the surgical leaders of three or four decades ago hardly envisaged

A summary of the history of operative surgery in the treatment of abdominal cancer cannot be complete without mention of the important investigations in the clinical management of shock and fluid balance (review by Blalock) and the developments in modern anesthesia culminating in the continuous spinal technique devised by W T Lemmon of Philadelphia Because of the former supportive treatment during and after extensive operations can be afforded which permits the toleration of extensive surgical procedures and because of the latter these procedures are greatly facilitated by the sustained complete relaxation not possible by other methods of anesthesia without much greater danger to the patient

CHAPTER II

OPERABLE AND INOPERABLE CARCINOMA

Surgeons have gone too far in the radical treatment of carcinoma of the pylorus.—NICHOLAS SENN in *Pathology and Surgical Treatment of Tumors*, published in 189[illegible].

THE term "operable" in connection with intra-abdominal neoplasms has been employed with a wide variation in significance. In general what is meant by an "operable neoplasm" is one that can be encompassed readily by more or less standard techniques, there being no gross evidence of widespread metastases. It is inferred that the immediate prognosis is favorable. The term "inoperable" is usually employed in connection with neoplasms for which, in the opinion of the operator, a radical procedure is not justified because of poor prognosis. This term is also used to designate the situation in which a neoplasm, possibly small and in itself resectable, has already given rise to visible spread beyond the possibility of complete excision. In the latter sense the term "inoperable" and the evident immediate prognosis become confused, since frequently the primary growth is indeed resectable but there seems to be little justification for resection. The confusion of "inoperability" with "poor immediate prognosis" undoubtedly fosters not a small degree of conservatism in the surgical attack upon intra-abdominal cancer.

The term "operable" should be dissociated from any connotation as to prognosis and also from any implication as to local or distant spread. An "operable" neoplasm is indeed one that can be excised, regardless of where or how much spread has developed. An inoperable neoplasm is one which cannot physically be excised because of size and location, and because if excision is attempted the incisions of necessity will have to pass through microscopically visible tumor tissue. Thus neoplasms, while operable, may permit of only a poor immediate prognosis, and the decision as to whether or not local excision should be carried out must rest with the individual surgeon and will be conditioned by a number of factors, such as age of the patient, type of neoplasm, whether or not obstructions of one type or another are present, and whether these may not be relieved by relatively simple short-circuiting operations.

In most instances of intra-abdominal malignant neoplasms, serious

clinical manifestations develop relatively late in the evolution of the disease Hence as is well known most patients with these neoplasms are seen by the surgeon at a time when metastases have already been formed The majority of all patients with intra abdominal carcinoma subjected to operation die of malignant disease The frequency with which the patient seeks medical advice shortly *after first appreciation of symptoms, only to have* discovered at operation an advanced intra abdominal neoplasm, is indeed discouraging for the surgeon Great advances in therapy in this field must await the development of some biologic test for detection of malignant disease in its incipiency or, better still, the discovery of means for prophylaxis The realization of these possibilities appears remote at the present time On the other hand, the patients now presenting advanced cancer offer immediate problems for their management and the measures available must be exploited to the fullest extent

In the presence of advanced intra-abdominal cancer it is the surgeon s responsibility to do what is possible to prolong life with comfort A completely defeatist attitude in regard to advanced intra abdominal cancer is not justified in many instances since palliation sometimes to a striking degree may be possible by the extension of surgical therapy beyond limits defined by customary practice Such extension of operative therapy is possible by virtue of advances in the last two decades, in anesthesia knowledge of the problem of shock and preoperative and postoperative care To be sure the immediate operative mortality will be appreciable and gratifying as low mortality statistics are to the surgeon the obtaining of such statistics should not wield great influence in the practice of surgical therapy for advanced intra abdominal cancer It is needless to point out that the latter disease is invariably fatal and that risks of appreciable immediate mortality are justifiable when benefit may be afforded by the success of a surgical procedure On the other hand if surgical attack upon advanced intra-abdominal cancer is generally extended increased experience will result in achieving a lower mortality than obtains at the onset of the practice of such operative procedures For example in the earlier days of the combined abdominoperineal resection the mortality was 40–50 per cent after two or three decades the mortality of this operation has been reduced appreciably below this figure

The resection of inoperable tumors *often does afford considerable* palliation for a period at least in the relief of pain and in the general increased comfort incident to the reduction of considerable quantity of

parasitic tissue in the organism. The degree and quality of palliation in any individual instance cannot be accurately anticipated because of varying differences in the individual conditions. For example, in one patient with a large neoplasm of the colon invading the stomach above and the abdominal wall anteriorly about the umbilicus, there were only moderately severe symptoms of obstruction. After massive resection of the colon, adherent lower stomach, and periumbilical region of the abdominal wall, the patient was well and symptom free over 4 years later. In another patient there was excruciating upper abdominal and girdle pain due, as determined at exploratory laparotomy, to a carcinoma of the body of the pancreas which had metastasized to the liver. When the abdomen was open, it was decided to resect all but a portion of the head of the pancreas, since it was evident that the growth here was the cause of the pain. The patient survived for only one month, dying of carcinomatosis, and exhibited a rapidly progressive cachexia and finally icterus, which itself caused no disturbance. He was, however, markedly relieved from the severe pain which had prevented him from lying comfortably in bed without a narcotic. In the writer's opinion the procedure in the second instance was as justified as it was in the first patient cited above, but the type of palliation obtained was entirely different.

Prolonged survival in patients with advanced intra-abdominal cancer as a rule cannot be expected. However, with successful palliative procedures in the form of extensive resections of neoplastic tissue, survivals of one or more years may be anticipated in some instances. Such periods of survival in relative comfort constitute appreciable palliation, since in such patients, who usually exhibit sufficient disturbances to have justified laparotomy, survival for appreciable periods may hardly be anticipated when nothing is done.

If operative surgery is to be extended in these patients, what may be said of the wider limitations, since obviously they exist? Extensive peritoneal spread or many hepatic metastases may be regarded as major contraindications for massive resections, and operative treatment may be limited to short circuiting operations to relieve obstructions if these exist. Where there is no evidence of hepatic metastases (or where these are limited) or where there is no extensive peritoneal spread, massive resection of macroscopically visible neoplastic tissue may on occasion be justifiable even though it might at the time appear to be a futile undertaking. The fact that large neoplasms may be present without apparent hepatic metas-

tases but with easily resectable extensions indicates in itself that the organism has some resistance to the growth or that it is of a type which metastasizes late in its course and thus resection for palliation is all the more indicated

Since there is such a wide variation in the findings exhibited by patients with advanced intra abdominal cancer it is hardly possible to describe more or less standard technical procedures for removal of the growths each patient presents an individual problem in operative technique By a somewhat systematic presentation of the experiences gained with a series of 100 patients the endeavor is made to determine what might be accomplished by radically extending operative attack upon advanced intra abdominal cancer

CHAPTER III

NONSURGICAL CONTRAINDICATIONS TO RADICAL RESECTIONS OF ABDOMINAL CANCER

DURING the preoperative preparation for attempted resections of advanced intra-abdominal cancer the status of the cardiovascular-renal systems is investigated. Major disturbances may be of sufficient gravity to preclude surgical intervention on the basis of greatly enhanced operative risks in addition to those incident to the procedures themselves or on the basis that the life expectancy of such patients is so brief as not to warrant a major procedure itself directed only to palliation. These are problems which vary widely with each individual patient and the decision to proceed with the operation is governed by the conditions in each case.

It has been the author's general experience that middle-aged and elderly patients with cardiac disturbances stand properly conducted operations very well. On one occasion exploratory laparotomy was performed in a female patient because of the diagnosis of mesenteric thrombosis. The patient did not take the general anesthetic well, struggled considerably, and was then subjected to extensive intra-abdominal palpation and manipulation of viscera; no abnormalities were found. The correct diagnosis was established a few days later—the attack of severe abdominal pain was a manifestation of an acute coronary occlusion. Convalescence from the *operation was uneventful indeed and there was recovery from the* coronary accident.[1] In another instance a male patient in the hospital because of cardiac decompensation developed obstruction in the sigmoid. While presenting all the signs and symptoms of cardiac decompensation he was subjected to laparotomy and a typical Mikulicz resection of the sigmoid was rapidly performed with immediate satisfactory recovery. During convalescence there were several acute exacerbations of cardiac failure but recovery from these as well as from the operation ensued. He died several months later of cardiac failure having successfully undergone some time previous to death closure of the colostomy. Additional similar in-

[1] This patient F. W. (227C?4) was still living more than 8 years after operation.

stances might be cited There is little difference between an easily performed Mikulicz resection and simple colostomy as far as strain' on the patient is concerned

The writer has also frequently performed cholecystectomy without complications in patients subject to repeated attacks of gall stone colic who also had various types of severe cardiac disturbances without fatality from acute cardiac failure that might have been attributed to the stress of the operation

In only one instance in the series considered in this essay was there a fatality due to acute cardiac failure This was a forty two year old patient who had previously received three operations for recurring carcinoma of the cecum over a period of $2\frac{1}{2}$ years Three weeks after the final operation he expired suddenly, and necropsy revealed coronary occlusion Cardiac disease had not been previously suspected because of lack of symptoms (Case 15)

While the value of preoperative study of the cardiovascular system can not be overestimated it would appear that definite prognoses as to the ability of patients to withstand surgical procedures on the basis of such studies are difficult indeed The presence of intra abdominal carcinoma is such an urgent surgical condition that only the severe manifestations of cardiac disease can be permitted to delay or indefinitely postpone surgical intervention Indeed recent publications by cardiologists indicate a realization that rest regimes for the cardiac patient have been overemphasized and that these patients tolerate physical activity to a greater degree than usually has been permitted them (Dock Harrison) This also means that they are probably better surgical risks than they were thought to be in the past

Certain forms of nephritis may be of such severity as to lead the internist to the position that surgical intervention could not be tolerated by the patient or that in spite of the presence of abdominal cancer such intervention is to be postponed until the nephritis is improved An example follows

Case 42—Kil (95437) 59 year old female admitted March 29 1944 complaining of general weakness noted since attack of acute streptococcus throat infection in January 1943 In April 1943 a physician had discovered 4+ albumin in the urine and hospitalized the patient for treatment of nephritis There was pronounced ankle edema and systolic blood pressure reputed to be 230 mm of Hg There were other periods of hospitalization during the summer and fall of 1943 for treatment of edema of the lower extremities (salyrgen etc) In November 1943 there were periods of difficulty in breathing and she had

to sleep partially upright. Digitalis had been prescribed. For the past 7 months she had appreciated the presence of a rounded mass in the right abdomen, not particularly painful.

Physical examination revealed the following salient features: rather marked pitting edema of the lower extremities and lower anterior and posterior abdominal wall to level of umbilicus; puffiness under eyelids; ascites; large, slightly movable, rounded mass 15 cm in diameter in right abdomen, attachment to liver could not be definitely determined; liver enlarged and smooth; fundi presented hypertensive retinopathy with hemorrhages, exudate and papilledema.

Blood pressure 202/114. E.K.G.: slight myocardial damage.

Urinalysis: 4+ albumin, specific gravity 1.02, sugar +. R.B.C. 3.9 M. W.B.C. 11,200. Hb. 13 gm. Plasma proteins 3 gm. per cent. Glucose tolerance test: diabetic curve.

Roentgenographic studies: Large right-sided abdominal mass extrinsic to bowels, kidney and gallbladder.

Clinical diagnosis (medical service): Chronic glomerulonephritis, mixed type, with anasarca; diabetes mellitus; abdominal tumor.

The physician in charge of the patient regarded her condition as unsatisfactory for operation, although an intra-abdominal malignant neoplasm was suspected. The author saw the patient in consultation and was of the opinion that attempt should be made to alleviate the nephritis and that laparotomy should be performed at the earliest moment. The internists were of the opinion that the outlook for life was probably about 6 months unless there was marked improvement.

The patient was treated in the hospital and then discharged on April 12, 1944, on a salt free diet, limited fluid intake, and proper measures for treatment of the diabetes. She was readmitted to the hospital on May 21, 1944. The edema and ascites had subsided except for slight pitting about the ankles. The abdominal mass was distinctly larger than a month previously. Roentgenographic study again revealed no evidence that it was primary in the alimentary tract or right kidney. Urinalysis showed 4+ albumin, 2+ sugar. Plasma proteins 5.7 gm. per cent.

Laparotomy was performed May 24, 1944, under continuous spinal anesthesia, as follows:

EXCISION OF LARGE MYXOFIBROSARCOMA OF RETROPERITONEAL SPACE
(Patient with Severe Glomerulonephritis)

1. The abdomen was entered through a right paramedian incision. A moderate quantity of clear fluid was aspirated. The serosal surfaces were everywhere smooth and glistening. No hepatic metastases were present. Bulging forward from the right retroperitoneal space, a large, yellowish oval mass about 18 cm. in greatest diameter was present. This pushed the ascending colon and loops of the small bowel to the left. It appeared to have definite limits and not widely to infiltrate the retroperitoneal spaces.

2. The entire length of the lateral leaf of the mesentery of the ascending colon was incised and the colon was reflected mesially. By gauze dissection it was possible to free all surfaces of the tumor. Mesially it was elevated from the anterior surfaces of the abdominal aorta and vena cava

It was found to have a pedicle composed of large vessels coming from the superior mesenteric trunks near the level of their passage over the terminal segment of duodenum This pedicle was clamped and divided

3 The mass was elevated from its bed after ligation of the smaller arteries and veins on its deeper aspects and was then removed

4 The incision in the mesentery of the ascending colon was closed and the abdominal incision was closed in layers without drainage

The surgical specimen is shown in Figure 1 It measured 17 × 15 × 8 cm and weighed 1 115 gm Freshly sectioned surfaces were moist glistening and grayish-yellow Microscopic sections showed myxoliposarcoma

Convalescence was uneventful and there was practically no fever The patient was discharged on the eighteenth day Two weeks after discharge she returned to the outpatient clinic there was slight malleolar edema no new retinal lesions no ascites Urinalysis 2+ albumin 0 sugar Plasma proteins 7 gm per cent Blood pressure 158/94

Three months after operation she again visited the outpatient clinic and had been normally active at home There was slight malleolar edema no ascites no new retinal lesions Urinalysis trace of albumin 0 sugar

Two years and four months after operation the general improvement is fully maintained, and she is normally active

The opinion of the internists at the first admission was that prognosis as to longevity was too poor for operation owing to the nephritis after 5 weeks of improvement on medical management they were of the opinion that operation might be attempted Regardless of the eventual outcome *the condition during the twenty eight month period following operation* was so satisfactory that it is evident that it was to her advantage to have had the large sarcoma excised This patient again illustrates the difficulty of arriving at definite prognoses in medical conditions which frequently exhibit periods of unexpected improvement (as do certain forms of chronic nephritis) and that when these patients present intra abdominal malignant growths that might be removed, too great consideration for the medical contraindications for operation should not prevent exploratory laparotomy

Hyperthyroidism may be coexistent with intra abdominal cancer A temporary remission may be brought about by bed rest and administration of Lugol s solution When the remission appears maximum laparotomy may be performed and during the postoperative period the administration of Lugol s solution is continued Thyroidectomy may be per

formed at a later date. On the other hand, rapid subsidence of the signs and symptoms and of the basal metabolic rate may be followed by thyroidectomy, and 10 days to 2 weeks later laparotomy may be performed. The latter program may be safer as far as the risks of postoperative (from laparotomy) thyroid crises are concerned.



FIG. 1.—Case 42 (05137). Liposarcoma weighing 1,115 gm. resected from right upper retroperitoneal space in patient with severe nephritis. *P*, *vascular pedicle transected near* superior mesenteric artery. Two years and 4 months after operation patient is well. Control of nephritis appears to be satisfactory.

It may be difficult in some instances to evaluate mild signs and symptoms of hyperthyroidism accompanied by moderate elevation in the basal metabolic rate. Patients with extensive neoplastic disease may exhibit basal metabolic rates higher than normal that are not due to true hyperthyroidism. A female patient observed by the writer exhibited what was interpreted as mild signs and symptoms of hyperthyroidism with a basal rate of +26. Following routine prethyroidectomy treatment, the rate fell to +8 and subtotal thyroidectomy was performed. This patient also had

a large tumor mass in the right upper quadrant which from roentgenologic examination appeared to originate from the right kidney Five weeks later she returned to the hospital for exploratory laparotomy The basal rate on this admission was found to be +28 Exploratory laparotomy revealed carcinomatosis and only biopsy was performed (section showed adenocarcinoma apparently primary in the kidney) Lugol's solution was administered for several days following operation and convalescence was uneventful

In lymphoblastoma and Hodgkin s disease the basal metabolic rate also may be elevated and does not indicate true hyperthyroidism

The modern methods of management of diabetic patients have reached such a high proficiency that diabetes no longer constitutes a contraindication for extensive surgical procedures The diabetic with advanced cancer is not subjected to operation until the diabetes is thoroughly controlled

Pneumonic processes undoubtedly constitute the most serious contraindications to abdominal operations The use of local or spinal anesthesia would not appear to minimize the risks attendant upon laparotomy under these circumstances Every effort is made to avoid abdominal operations in the presence of such pulmonary conditions and if these operations are of extreme urgency they are limited to the briefest short circuiting procedures possible under local anesthesia to relieve the acute situations present Furthermore if resorption of the pneumonic lesions obtains laparotomy is delayed as long as possible following apparent recovery from the pulmonary conditions since patients undergoing major abdominal procedures for cancer are highly subject to postoperative pneumonia

CHAPTER II

SUPPORTIVE TREATMENT FOR PATIENTS UNDERGOING EXTENSIVE INTRA-ABDOMINAL OPERATIONS

As INDICATED previously, one of the principal limiting factors for radical intra-abdominal operations in the past was the relative lack of effective supportive treatment during the operation and during the preoperative and postoperative periods. Present-day knowledge of the etiology, prevention and treatment of shock is the most important factor in facilitating the extension of operative surgery in the treatment of intra-abdominal cancer, as well as greatly facilitating all other types of major procedures. Also of importance is the appreciation on the part of surgeons of the nutritional state of patients in relation to their ability to tolerate radical procedures. The details of preoperative and postoperative treatment vary with individual surgeons. In the following discussion the principles followed by the author with patients subjected to extensive surgical resections are outlined. These measures were carried out with most of the patients reported in this treatise and are therefore not repeated in connection with the individual case histories. Patients who are to be subjected to extensive resections should be hospitalized for several days prior to operation, in order that suitable preparation may be carried out.

PREOPERATIVE MEASURES

ANEMIA

The frequency of secondary anemia in patients with advanced intra-abdominal cancer is generally appreciated. Patients whose erythrocyte count is below 4,000,000 per cubic millimeter should receive sufficient blood transfusions to elevate the erythrocyte count at least to this level preoperatively.

FLUID BALANCE

A daily urinary output of 1,000–1,500 cc. is envisaged, as this indicates adequate fluid balance. Where there has been frequent vomiting or low intake of food and fluid prior to admission, the dehydration is corrected by infusion of 1,500–3,000 cc. of suitable fluids daily, in addition to that taken by mouth, in order to achieve the urinary output mentioned above.

If there has been considerable vomiting blood chloride estimations are obtained to ascertain the circulating chloride level (normal sodium chloride 560 mg per cent) and, if depleted physiologic saline or Ringer's solution infusions are indicated According to Coller and associates 1 gm of sodium chloride per kilogram body weight is required for every 100 mg per cent of the plasma sodium chloride level under 560 mg per cent

VITAMINS

Adequate general diets include sufficient quantities of the various vitamins Where intake of food has been curtailed for prolonged periods relative avitaminosis may obtain In the brief period of peroperative preparation liberal quantities of vitamin preparations may be prescribed Almost all the known vitamins may now be administered parenterally in pure or relatively pure form and where emaciation is pronounced these preparations may be given It must be emphasized however, that vitamins alone are of little nutritional value Their beneficial action is conditioned upon adequate dietary intake

Two vitamins are of special interest in the surgical patient vitamin C (ascorbic acid) and vitamin K Extensive observations (Lund) have shown that fibroplasia in healing wounds is impaired when the organism is depleted of ascorbic acid Adequate quantities of vitamin C must therefore be available in patients who are to be subjected to major surgical procedures The level of vitamin C may be determined in the circulating blood the lower limit of the optimum being 1 2 mg per cent Adequate vitamin C reserves may be achieved by the daily intake of 150–300 mg of ascorbic acid either in the form of capsules or parenterally Daily administration of 1 gm of ascorbic acid has been recommended to insure rapid repletion

Adequate reserves of vitamin K are necessary for the production by the liver of prothrombin thus insuring proper blood coagulation In patients presenting a poor nutritive state the plasma prothrombin level may be reduced below normal In patients with obstructive icterus of some weeks duration the prothrombin level may also be reduced because of impaired absorption of vitamin K from the bowel since a certain concentration of bile salts in the intestinal contents is necessary for absorption of vitamin K The latter may be administered in tablet form with bile salts or it may be administered parenterally in the form of the synthetic product Prothrombin determinations should be routinely performed in all patients

who have been on reduced dietary intake and of course in all icteric subjects. With injections of adequate quantities of vitamin K the plasma prothrombin level should return to normal within 24 hours provided that the liver function is not impaired. In the presence of hepatic injury the normal plasma prothrombin level will be achieved more slowly or not at all. Thus prothrombin responses to vitamin K administration constitute a liver function test.

GENERAL NUTRITIVE STATE WITH SPECIAL REFERENCE TO PROTEIN METABOLISM

Undernourished subjects present greater operative risks than those in a good state of nutrition. Patients with advanced intra-abdominal carcinoma usually are in a poor nutritive state. It is not practicable to bring about appreciable gain in weight in these patients. Frequently the presence of obstructions of the alimentary tract necessitate surgical intervention at the earliest moment possible and certainly preclude long periods of nutritional preparation before operation. Aside from the bowel obstructions, the patients themselves have little appetite and tend to continue on a limited food intake if left to their own devices. In the absence of obstructions, high caloric, high carbohydrate, and low fat diets should be prescribed to the equivalent of at least 40 calories per kilogram body weight. If necessary, the daily dietary intake should be divided into six or more small meals.

Protein is the most important foodstuff since this is necessary for synthesis of protoplasm. Furthermore, the recent studies of P. R. Cannon have shown the close relationship between adequate protein metabolism and resistance to infection. In protein-depleted animals, antibody production was markedly impaired. The apparent low resistance of poorly nourished patients to infectious processes has long been recognized. The implications of the importance of the state of protein nutrition in patients to be subjected to extensive operative procedures is clear.

Aside from the general clinical appearance and recent dietary history of the patient, one index of the state of protein metabolism is afforded by the level of the circulating plasma proteins. In the absence of hemoconcentration, the plasma protein level should be at least 6 gm. per cent. Some authors have recently stated that plasma proteins are usually below normal in the patient with advanced abdominal cancer, but in the writer's experience this has not been observed. Patients in obviously poor nutritive state with histories of substantial weight loss and curtailment of appetite

for months or weeks, have often been found to have normal plasma protein levels in the absence of hemoconcentration. The latter findings, however, do not minimize the importance of protein nutrition in these patients. They simply indicate that normal plasma protein levels per se do not give assurance of adequate protein nutrition.

The surgeon, if possible, should not undertake extensive operative procedures in patients with plasma protein concentration of less than 6 gm per cent. If the latter situation obtains and is not corrected by blood transfusions which are given for anemia, plasma transfusions of 500 cc daily may be given to totals of 1,000–2,000 cc or more if possible and necessary. Recently it has become feasible to administer nitrogenous nutriment intravenously in the form of casein digests, amino acids and gelatin. These will be discussed in a subsequent section of this chapter, but suffice it to state here that the writer has been unable to observe appreciable regeneration of plasma proteins above the initial level in protein depleted human patients by the use of intravenous casein digests as the principal source of nitrogen. The latter, however, did serve to meet current requirements and thus spared further depletion of body protein. The probable explanation for failure to demonstrate increased plasma protein regeneration in these patients is that sufficient quantities of the nitrogenous nutriment (casein digest) were not injected. According to the studies in dogs and theoretical calculations of Sachar, Horwitz, and Elman, a *storage* of 30 gm of protein must be achieved for increases in other proteins of the body in order to permit of 1 gm increase in serum albumin. The magnitude of the protein storage necessary to achieve actual elevation of circulating plasma proteins by dietary intake or by intravenous injection is indicated.

PREPARATION OF THE LIVER

The problems of hepatic physiology in the surgical patient have been considered at great length in the monograph by Boyce and discussion of these questions will not be undertaken here. Since the events associated with a major surgical procedure have been shown by liver function tests to impair hepatic function at least temporarily, it follows that hepatic dysfunction, if already present, very materially increases the operative risk. The investigations of Ravdin and his associates have shown that the liver may be rendered less liable to injury by chloroform anesthesia if there is previous increased hepatic storage of protein and carbohydrate. Such storage reduces the fat content of this viscus and susceptibility to

chloroform injury is directly proportional to its fat content. Whipple has reported that preliminary feeding or injection of the amino acid methionine also renders the liver less susceptible to chloroform injury. The writer in conjunction with Bigelow and Nichol presented evidence to indicate that the protective action of protein and methionine against chloroform injury to the liver is associated in some way with the —SH component. From the above it would appear that preoperative feeding of high calorie, high protein, high carbohydrate, and low fat diet might well afford preparation of the liver against the physiologic strains that this organ is subjected to in the course of a major surgical operation. To be sure, chloroform is rarely, if ever, employed in this country for surgical anesthesia, yet those measures which have been demonstrated to protect the liver in the experimental animal from this type of injury may well be employed as a means for bringing this organ into the best possible condition prior to operation. The rationale of a preoperative high calorie, high protein, high carbohydrate, and low fat diet is thus apparent. In patients who cannot or will not consume an adequate diet by mouth, preoperative preparation of the liver along the lines indicated above can be carried out by intravenous nutrition with nitrogenous substances and glucose.

In the past few years, as stated above, it has become possible to inject hydrolyzed casein intravenously with metabolic effects quite similar to those obtaining when comparable amounts of protein are taken by mouth (Table 6). In many of the patients discussed in this essay such measures were employed. If the patient had been eating at least moderate quantities of a general diet, 1,000 cc. of 5 per cent casein digest in 5 per cent glucose were injected each day for 2 days prior to operation. Each injection represents 50 gm. of protein and 50 gm. of dextrose in addition to the high protein, high carbohydrate, and low fat diet prescribed. If the patient was in poor nutritive state, greater quantities were injected for several days preoperatively.

To test the efficiency of the intravenous casein digest in protecting the liver against injury, dogs were anesthetized with chloroform and daily bromsulphalein liver function tests carried out to obtain data on the magnitude of liver injury. Eight or more weeks later the dogs were again subjected to chloroform anesthesia given in the same manner, for the same length of time, and receiving the same amount of chloroform per kilogram body weight as previously. The degree of hepatic damage as shown by the bromsulphalein test was the same as, or greater than, on the first occasion

In other dogs at the second anesthesia casein digest (2 5–3 gm per kilogram total dose) was injected intravenously at intervals during the period of anesthesia and once or twice during the 5 or 6 hours following recovery. Daily bromsulphalein excretion tests were again carried out the *initial* degree of injury was either approximately the same or was less than following chloroform anesthesia alone and *recovery* from injury *was appreciably more rapid* when the digest was injected as compared to the previous control experiment in the same animal. The results of some of the experiments are shown in Table 1

TABLE 1

THE PROTECTIVE ACTION OF INTRAVENOUS CASEIN DIGEST AND METHIONINE ON THE LIVER OF DOGS ANESTHETIZED BY CHLOROFORM. FAILURE OF PROTECTION WITH GLUCOSE*

Dogs	Days after Anesthesia (Bromsulphalein Test Per Cent of Dye Retained in 20 Minutes)						
	1	2	3	4	5	6	7
Dog 972 weight 5 kg 2/9/44 1 5 cc chloroform per kilogram weight in 60 minutes	26	30	25	8	2	Trace	0
4/5/44 anesthesia as above 225 cc 10% casein digest injected during anesthesia	24	14	6	Trace	Trace	0	0
Dog 112 weight 4 8 kg 4/26/44 1 7 cc chloroform per kilogram weight in 45 minutes	40	40+++	32	24	24	20	12
8/24/44 anesthesia as above 150 mg methionine injected per kilogram weight during anesthesia	32	36	32	8	8	4	Trace
Dog 747 weight 8 4 kg 4/14/44 1 6 cc chloroform per kilogram weight in 50 minutes	32	24	16	8	0	0	
8/30/44 anesthesia as above 3 gm glucose per kilogram weight injected during anesthesia	40	32	16	12	8	2	

* [illegible]

These observations enhance confidence in intravenous *casein digests* as one means of rapidly conferring protection upon the liver against the physiologic strains induced by extensive intra abdominal operations. Methionine an amino acid was also found to protect the liver against chloroform injury in experiments similar to those described above (Table 1) Possibly the protective action of casein digest is due to its methio

nine content (3 per cent by weight). At this writing, methionine is not readily available, but casein digests for intravenous use are being manufactured by various pharmaceutical houses and are generally available.

The question of "hepatorenal" syndrome has been extensively discussed in the literature, and it is sufficient to state that the known measures of demonstrated efficacy for liver protection are indicated in patients with icterus, especially of severe degree and long standing owing to neoplastic obstruction of the bile ducts.

Studies have been reported (Abels, Rekers, *et al.*) to suggest that patients with cancer of the gastrointestinal tract frequently have several abnormalities of hepatic function. In the author's opinion, conclusive evidence has not been afforded to indicate that hepatic dysfunctions are specifically a part of the general disturbances which might underlie the development of such cancers. It would appear that prolonged inadequate dietary intake, loss in weight, etc., could account for such changes. It is generally recognized that starvation, relative or absolute, is accompanied by increase in the lipoid content of the liver, and this in itself may afford hepatic dysfunction in such subjects. Furthermore, the writer has observed large numbers of patients with carcinoma of various types who have had varying periods of inadequate nutrition and in whom the plasma proteins were within normal range, and this was not accounted for by hemoconcentration. Regardless of etiology, however, the patient with advanced intra-abdominal cancer frequently presents hepatic dysfunction which must be evaluated and rectified, if possible, prior to operation.

CATHARSIS

Little discussion need be given here of the question of preoperative catharsis by drugs or enemata. The advantages of the deflated alimentary tract in patients subjected to laparotomy have been well recognized for decades. It is especially important that no barium ingested during roentgenographic studies remain in the digestive tract at the time of operation. If there is a question of this, massive resections, especially those involving the bowel, should not be undertaken until all barium has been evacuated. In the presence of appreciable degrees of obstruction in the alimentary tract, retained barium may be evacuated by enemata and by gastric aspirations. Where such degrees of obstruction do not exist, the writer prescribes 30–60 cc. of castor oil at night and 60 cc. of 50 per cent magnesium sulphate in the morning during the third and second days pre-

operatively Dietary intake is reduced the day before operation Such catharsis entails considerable fluid loss which may occasion serious imbalance and which should be compensated for by hypoclyses of 1 500 cc of normal saline each day In a wide experience no instance of severe hemorrhage from a neoplasm in the alimentary tract induced by this regimen has been observed Exceptions are to be made in very asthenic and elderly patients, since they do not tolerate energetic catharsis

OPERATIVE MEASURES

ANESTHESIA

Extensive surgical procedures within the abdomen are greatly facilitated by maximal muscular relaxation This is best afforded by the continuous spinal anesthesia which unless contraindicated is the type of anesthesia employed in these operations Supplementary inhalation anesthesia may in some instances be required especially in procedures in the upper abdomen

TRANSFUSIONS DURING OPERATION

Supportive treatment by blood and plasma transfusions is the most important single factor for the facilitation of massive resections It has been shown that the actual blood loss, as determined by the amount present on sponges and linens is usually much greater than estimated by the surgeon Wangensteen found that about 300–500 cc were lost during gastrectomies Buxton and White found 700–1 600 cc for major thoracic operations Coller *et al* found an average of 410 cc for combined abdominoperineal resections and 600 cc for complicated gastric resections Inasmuch as massive resections of intra abdominal carcinomas are not routine procedures there are no means for predicting the amounts of blood that will be required except that these quantities will be greater than for routine procedures The writer adheres to the following plan As the patient is being draped an intravenous infusion is begun with 200 cc of normal saline in the flask As soon as the decision is made to undertake the massive resection blood is poured into the flask The anesthetist reports the blood pressure pulse and respirations at frequent intervals The rate of transfusion is varied to maintain the systolic pressure at approximately the patient s normal level As frequently happens when this cannot be maintained a minimal systolic pressure of 100 mm of Hg is envisaged If one transfusion set is not sufficient to afford the desired rate another outfit is set up for another extremity

The author is not in accord with those who take the position that the liberal use of transfusions is indicative of poor surgical technique, especially in regard to hemostasis. The time factor is most important for the patients undergoing massive resections, and the clamping and ligation of each small bleeding or oozing point is not feasible in this type of surgery if the desired ends are to be achieved. Pressure on the wound margins with laparotomy pads wrung out in hot saline solution serves to arrest much of the bleeding, not, however, until after there has been some loss of blood. The extensive manipulations of abdominal viscera induce stagnation of blood in the splanchnic areas and exudation of plasma in the manipulated viscera; also considerable blood is removed with the large surgical specimens as they are resected, not to mention the sudden extensive losses due to accidental opening of large vessels. Extensive interventions cannot be envisaged without substantial quantities of blood and plasma immediately available. As stated above, each patient presents an individual problem. Quantities of blood totaling 1,500 cc. are frequently necessary, and often such quantities as 2,000–3,500 cc. are necessary. Furthermore, the fall in blood pressure due to spinal anesthesia must be compensated for by blood transfusion.

Table 2 summarizes the quantities of blood and plasma employed by the writer in some of the patients subjected to extensive procedures.

Some authors (Ivy *et al.*, Bruneau and Evarts Graham) have indicated that the liberal use of citrated blood and plasma in dogs may entail certain hazards of citrate intoxication. The studies of Allen, Clark, Thornton, and Adams would indicate that the risk of citrate poisoning associated with extensive use of blood and plasma transfusions in man, as discussed in the preceding paragraphs, is negligible. Their studies were based upon 52 patients who received 1,500–7,000 cc. of citrated blood and plasma during the 6 hours beginning with the operation. The quantities of citrate received were equivalent to 0.1–0.3 gm. per kilogram body weight during 2–3 hours. In dogs the lethal dose of sodium citrate was found to be 0.3 gm. per kilogram given in 15 minutes or less. In the writer's experience the liberal use of citrated blood and plasma has never been associated with noxious effects attributable to the citrate. Following operation, blood pressure determinations are made at frequent intervals. In some instances the blood pressure will exhibit a precipitous fall during the first night following operation and not be associated with obvious hemorrhage (so-called "secondary shock"), the etiology of which is not apparent). Should

the pressure fall below the 90 mm of Hg systolic, blood or plasma transfusions are indicated and are repeated if necessary, to elevate the pressure to satisfactory levels

POSTOPERATIVE MEASURES

FLUID BALANCE

Inasmuch as a considerable literature has recently appeared on this subject, little detailed discussion is necessary here The urine output on

TABLE 2

QUANTITIES OF BLOOD AND PLASMA TRANSFUSED IN SOME INSTANCES OF MASSIVE RESECTIONS

(Quantities of Saline Not Included)

Patient	Weight (Kg)	Diagnosis	Operation	Transfused Citrated Blood and Plasma (I Cc)
M G ♀	67	Recurrent malignant chordoma sacrum	Resection of malignant cardoma and large portion of sacrum	2 500 (blood)
H H ♂	65	Carcinoma pancreas	Total pancreatectomy	3 200 (blood)
W F ♂	73	Recurrent carcinoma stomach	Excision of recurrences cholecystectomy partial hepatectomy	3 500 (blood)
H D ♀	65	Carcinoma neck of pancreas	Pancreatoduodenectomy	3 500 (blood) 2 600 (plasma)
C J ♂	61	Sarcoma duodenum	Resection of sarcoma of duodenum	2 400 (blood) 300 (plasma)
C C ♂	53	Perforated carcinoma stomach	Total gastrectomy and resection of body of pancreas and spleen	3 100 (blood)
Mal ♀	52	Pedunculated hypernephroma extending forward in mesentery of descending colon	Resection of hypernephroma spleen left kidney	2 400 (blood)
Webst ♂	61	Carcinoma body of pancreas extending onto stomach	Total gastrectomy total pancreatectomy duodenectomy and splenectomy	2 800 (blood) 800 (gelatin)
Boik ♂	58	Lymphosarcoma of stomach invading upper abdomen	Total gastrectomy partial hepatectomy and pancreatectomy transverse colostomy splenectomy etc	2 400 (blood) 800 (plasma)
Ler ♂	39	Large carcinoma left adrenal	Excision of tumor left kidney body and tail of pancreas portions of diaphragm retroperitoneal tissues	2 400 (blood) 1 200 (plasma)

the day following operation and on each day thereafter should approximate 1,000-1,500 cc. Usually an intake of 3,000 cc. of fluid per 24 hour period will afford this output. The important guide to adequate fluid balance is the volume of urine excretion and not the quantity of ingested fluid. The quantity of fluid to be ingested in order to achieve the aforementioned volume of urine will vary considerably depending upon the extent of perspiration, vomiting, gastric aspiration, etc. Thus, not infrequently large quantities (4-6 liters or more) of fluids must be administered to compensate for the excess losses. In the administration of such fluids care is exercised not to exceed physiologic limits of chloride ingestion or total quantity of water. Hyperchloremia and "water intoxication" are to be avoided. Also the danger of inducing pulmonary edema and acute cardiac failure from fluid administration in excess quantity or too rapidly is to be borne in mind.

SUPPORT BY PARENTERAL NITROGENOUS NUTRITION

The patient with advanced intra-abdominal cancer is almost invariably in poor nutritional state. The general physiologic strain entailed by massive resections greatly taxes his general physiologic economy. One feature of the immediate postoperative period is the excessive protein catabolism as evidenced by high nitrogen excretion in the urine. In a series of 41 surgical patients placed upon nitrogen balance studies beginning with the day of operation and carried out for 10 days, the writer in conjunction with D. I. Clark and N. Corbin observed in all but 5 instances a net nitrogen loss (see Table 3). These patients began to ingest the usual postoperative diets after the third to fifth day, and there was a net loss at the end of 10 days in spite of this intake. During the first 5 days, when little or no food was taken, the nitrogen loss was frequently excessive, being as high as 25-30 gm. in some instances. The exact mechanism of the stimulation of protein catabolism after operation is not clear. Postoperative febrile reactions, ileus, and relative starvation contribute to excessive protein catabolism but cannot account for the major part of it. It would appear that the general disturbances incident to anesthesia and laparotomy are also important causes, but, as stated, the exact mechanism by which these factors operate is not yet understood. The more extensive the operation, the greater the nitrogen loss, regardless of smoothness of convalescence.

The studies of George Whipple and others indicate that protein as

TABLE 3

NET LOSS OR GAIN IN NITROGEN IN 10-DAY POSTOPERATIVE PERIOD IN 41 PATIENTS UNDERGOING A VARIETY OF MAJOR SURGICAL PROCEDURES

Operation	Patient	Net Nitrogen Loss or Gain in 10-Day Postoperative Period (Gm.)
Thoracic sympathectomy	L. M.	−27.10
	McM.	−68.47
Esophagoplasty	Ril.	−75.17
Exploratory celiotomy	Windb.	−65.37
	Bernt.	−16.86
	Valent.	−3.81
Appendectomy (peritonitis)	Ad.	−49.17
Gastric resection	Neh.	−73.53
	Maz.	−175.79
Repair of perforated peptic ulcer	Ly.	−136.06
Cholecystectomy	Fish.	−24.34
	Thomp.	−27.78
	Miller	−23.18
	Lew.	−20.74
	Barger	−75.90
	Patton	−24.73
	Bohl.	−68.95
	Glynn	+5.91
	Clayt.	−36.44
	Mal.	+1.13
	Pears.	−114.09

Operation	Patient	Net Nitrogen Loss or Gain in 10-Day Postoperative Period (Gm.)
Radical mastectomy	Rawl.	+1.23
	Meed.	−15.68
	Shaw	−13.51
Operation on extremities	Burdi.	−9.98
	Kit.	−6.21
	Cal.	−30.00
Thyroidectomy	Anth.	+4.41
Herniotomy	Berb.	−18.35
Gastroenterostomy	Hag.	−47.96
Partial colectomies	Robert	−20.72
	Boyer	−60.22
	Zaraz.	−51.86
	Benk.	−49.48
	Schr.	−69.87
	Fhl.	+4.97
	Steph.	−41.44
	Thomp.	−59.68
Operations on pancreas	Rapacz	−39.96
	Fait	−24.41
	Cullen	−61.02

SUMMARY OF DATA ON NITROGEN LOSS IN 10-DAY POSTOPERATIVE PERIOD

A. Group I: 18 patients lost up to 40 gm. of nitrogen; average 21.31 gm.
Group II: 7 patients lost 41–60 gm. of nitrogen; average 51.4 gm.
Group III: 11 patients lost 61–175.8 gm. nitrogen; average 89.45 gm.
Group IV: 5 patients gained 1.13–5.91 gm. nitrogen; average 3.54 gm.

B. Calculated dry weight* of protein lost (Group I) = 133.19 gm.; this represents 0.67 kg.† wet body tissue.
Calculated dry weight of protein lost (Group II) = 321.25 gm.; this represents 1.6 kg. wet body tissue.
Calculated dry weight of protein lost (Group III) = 549 gm.; this represents 2.7 kg. wet body tissue.

* Gram of excreted nitrogen × 6.25.

† Calculated on the assumption that the total relation between protein to water is that of 1:3 (Best and Taylor: *Physiological Basis of Medical Practice* [2d ed.; Baltimore: Williams & Wilkins, 1940], pp. 915–16).

homologous plasma infusions may be utilized for nutritional purposes in that nitrogen equilibrium or a positive balance may be achieved by such infusions as the sole source of nitrogen. From a practical standpoint it would be difficult indeed to obtain sufficient quantities of plasma, even from banks, adequately to nourish patients in an active general hospital. In the past few years it has become possible to administer nitrogenous nutriment by vein to human patients. The most frequently employed solution is an enzymic digest of casein and hog pancreas (Amigen). Elman and Weiner in 1939 were the first to demonstrate the safety of administration of such solutions in man. They employed an acid hydrolysate to which tryptophane was subsequently added. In 1942 the writer in conjunction with D. E. Clark and N. Corlan demonstrated that the enzymic hydrolysate given intravenously to protein depleted dogs as the *only source* of nitrogenous nutriment afforded plasma protein regeneration since there was a significant elevation of the circulating plasma protein level. Casein is a highly efficient protein because it includes all essential amino acids and, as the sole protein in the diet, will permit of normal growth and development of experimental animals. Hence the choice of digested casein for parenteral nitrogenous nutriment is justified.

Earlier in this chapter it was stated that a significant elevation of circulating plasma protein levels was not achieved in human patients by the intravenous injection of casein digest and that the reason for this was the insufficient quantities used. Also it was not feasible to delay operation for prolonged periods in order to obtain this elevation. In the writer's experience to date, the chief benefit of parenteral nitrogenous nutrition by casein digest has been the *prevention* of further excessive loss of nitrogen and hence catabolism of body protein in patients subjected to massive resections. Given that these patients are already undernourished and that they are subjected to a surgical procedure which entails further extensive destruction of their body proteins, prevention of the catabolism constitutes an important method of supportive treatment, and indeed it is conceivable that such sparing of excessive wear and tear on the organism might be a deciding factor in tipping the scales in favor of a fortunate outcome from the operation. This sparing effect results from the utilization by the organism of the injected nitrogenous foodstuff instead of its own protein. In some instances there has actually been appreciable storage of injected nitrogenous nutriment, thus indicating that protein anabolism was possible in addition to meeting the needs of continued existence.

In patients who are admitted to the hospital in poor general condition not good risks for immediate operation and who have high grade obstruction of the gastrointestinal tract and therefore cannot be fed by mouth parenteral nutrition has been employed to carry the patient through the period of preoperative preparation lasting sometimes for days thus affording an improvement in the nutritional state An example of this is a thirty-eight year-old female patient first seen in consultation with the gynecological service because of a large pelvic mass which produced obstruction of the colon A fungating mass had been excised from the cervix a few weeks previously and appeared histologically to be a leiomyosarcoma X ray therapy was given and not well tolerated At home there was distention nausea and vomiting On physical examination at this admission a large mass was palpable in the pelvis, and there was lower abdominal rigidity Barium enema revealed obstruction in the upper pelvic colon due to ' extrinsic mass ' The patient exhibited a ' Hippocratic facies the temperature was 101° F , the W B C , 18 000 The impression was acute pelvic inflammatory disease with possible coexistent sarcoma Continuous gastric aspiration was instituted, and intravenous nutrition was carried out for 13 days Nothing was permitted by mouth The patient was placed on a nitrogen balance regime and the results are summarized in Table 4

From Table 4 it is seen that marked positive nitrogen balance was achieved each day (except 2) during the 13 day period The nitrogen storage during this period was equivalent to 48 13 gm which represents 300 81 gm of protein (dry weight) During this period the patient improved markedly A barium enema on the eleventh day revealed a partial relaxation of the obstruction in the rectal colon and at laparotomy on the fourteenth day a large pelvic abscess was drained No evidence of sarcoma was observed and full recovery ensued

The solutions injected daily into this patient consisted of the following

a) 1 500 cc 10% casein digest (Amigen) = 150 gm casein = 18 gm nitrogen } mixed
b) 1 500 cc 10% dextrose = 150 gm dextrose } in
c) 1 500 cc 10% dextrose in normal saline = 150 gm dextrose } flasks
(13 5 gm of chloride were given daily because of the constant gastric aspiration)

The caloric equivalent was as follows

300 gm dextrose	=	1 200 calories
150 gm casein digest	=	540
		1 740

The patient weighed 60 kg. The calories per kilogram = 35, which is a good dietary intake for a patient at bed rest. (Some of the nutriment was excreted unutilized in the urine; hence the nutriment actually available did not represent the full equivalent of 35 calories per kilogram.)

Nitrogenous nutriment with glucose may be administered postoperatively from the first day in order to afford nutrition at the earliest moment possible and may be continued even after food is taken by mouth in order

TABLE 4

NITROGEN BALANCE IN PATIENT R. E. ([illegible]) DURING 13-DAY POSTOPERATIVE PERIOD

(Nothing by Mouth. All Nutriment Was Given by Vein)

Day	Nitrogen Intake (Amino Acids Digested*) Gm.	Carbohydrate Intake (Dextrose) Gm.	Output Nitrogen (Urine) Gm.	Daily Nitrogen Balance (Gm.)
1	18	300	4.98	+15.02
2	18	300	10.32	+ 7.68
3	18	300	10.60	+ 7.40
4	18	300	12.39	+ 5.61
5	18	300	15.16	+ 2.84
6	18	300	14.10	+ 3.90
7	18	300	17.45	+ 0.55
8	18	300	15.58	+ 2.42
9	18	300	13.80	+ 4.20
10	18	300	14.78	+ 3.2
11	6	300	8.59	− 2.59
12	6	150	7.03	− 1.03
13	6	0	5.09	+ 0.91

Total nitrogen stored during 13 days = 48.13 gm. = 300.81 gm. protein (dry weight).

* Amigen.

to increase the nutritional intake. An example of this is afforded by one patient (Case 12 [261391]) (see chap. xviii) who was subjected to laparotomy because of the clinical diagnosis of recurrent carcinoma of the uterus producing obstruction of the colon but in whom radiation necrosis of the colon was discovered and the necrotic portion excised. Intravenous feeding was carried out with the solutions described above, and the nitrogen balance studies are summarized in Table 5.

It is seen from Table 5 that a positive nitrogen balance was achieved from the day of operation and that during the 6 day period when nothing was taken by mouth a total of 23.31 gm. of nitrogen were *stored*, which represents 146 gm. of protein. Convalescence was satisfactory and eventual recovery ensued (chap. xviii).

The average human subject excretes 11–12 gm. of nitrogen in the urine daily and loses 1–2 gm. of nitrogen in the stool on the usual *mixed diet* with normal activity.

In *determining the quantity of digest to inject daily*, an intake of 2–3 gm. of the protein per kilogram body weight is envisaged. Obviously this will not all be retained, but, as stated previously, a sparing effect upon the catabolism of the body's own proteins will be afforded. Nitrogen storage cannot be obtained by the injection of the casein digest alone, as caloric requirements for energy are the first requirements to be satisfied and the injected nitrogenous nutriment will be utilized for this if other sources of

TABLE 5

NITROGEN BALANCE STUDIES IN PATIENT (CASE 19) RECEIVING INTRAVENOUS CASEIN DIGEST AND GLUCOSE FOR 6 DAYS FOLLOWING OPERATION
(Nothing by Mouth)

	DAY OF OPERATION					
	1	2	3	4	5	6
Nitrogen intravenously (casein digest) (gm.)	18	18	18	18	18	18
Total nitrogen excretion (gm.)	13.20	16.25	17.64	14	10.3	13.3
Nitrogen balance (gm.)	+ 4.8	+ 1.75	+ 0.36	+ 4.0	+ 7.7	+ 4.70
Dextrose intravenously (with saline) (gm.)	300	300	300	300	300	300

calories are not available. Hence adequate carbohydrate for caloric requirements must be afforded in the form of dextrose solutions. Utilization of dextrose for calories will spare the nitrogenous nutriment for protein synthesis. The injections of both digest and dextrose should be carried out *slowly*, otherwise rapid excretion of much of these nutriments in the urine will occur.

Minor untoward reactions may occur from the use of the digests described above. These consist of chills, rise in temperature, nausea and vomiting, feeling of depression, etc. After repeated injections they may eventually cease, and thus several trial injections should be carried out if it is highly important that nutritive support be given. Some patients do not appear to tolerate the injections at all, and hence they cannot be continued. The reactions do not represent anaphylactic phenomena, since extensive experimental studies have revealed that the digests are *not antigenic*.

Studies by the writer have also shown that certain solutions of gelatin (8 per cent in normal saline) injected intravenously are well tolerated by human patients, that about 40–50 per cent of the quantities injected are not recovered as gelatin in the urine, and that following such injections the urea excretion is elevated. Gelatin has the disadvantage of not containing all essential amino acids and hence does not afford normal growth and development in experimental animals when it is the sole source of protein in the diet. Studies by the author in conjunction with S. Nichols and R. Bigelow have shown that in protein depleted dogs, when gelatin is injected intravenously and fortified by addition of the amino acids—tryptophane, methionine, threonine and valine—as the sole source of protein building stones, in addition to a nonprotein diet of fat, carbohydrate, essential minerals and adequate vitamins, positive nitrogen balance is achieved with evidence of plasma protein regeneration. These studies suggest that gelatin also might be utilized clinically for intravenous nitrogenous nutrition when there are other sources for the missing essential amino acids. Data illustrating the beneficial effects of intravenous gelatin for nutritional purposes are given in connection with Case 40 (p. 79).

The efficacy of intravenous nitrogenous nutrition is further demonstrated by other studies in 12 patients carried out by the writer in conjunction with Sabra Nichols, in which the nitrogen balance was observed when all nitrogenous nutriment was given intravenously as casein digest and compared with the nitrogen balance when a comparable quantity of nitrogen was taken by mouth as food protein. Under the former conditions caloric requirements were met by intravenous glucose, and under the latter conditions caloric requirements were afforded by the dietary fat and carbohydrate. *In each period the total caloric intake for each patient* was the same when he was fed by vein and by mouth. In general the nitrogen balance under each set of conditions was approximately the same whether the nutrition was entirely by vein or entirely by mouth in a given patient (see Table 6). There were some exceptions, usually in favor of the period of oral feedings. However, since the periods of injection were during the 4–6 days immediately following operation, whereas the periods of oral feeding began several days after operation, the conditions of the experiment per se favor better nitrogen retention during the latter periods.

The whole field of parenteral nitrogenous nutrition is of recent development and therefore what has been said above in regard to methods can

be of only temporary significance Other types of solutions for these purposes are being and will continue to be, developed which will increase the efficiency of such methods of nutrition

ORAL FEEDINGS

Following extensive intra abdominal operations especially when the alimentary tract has been involved, distention nausea etc are to a large extent reduced or obviated if the patient is not required to ingest fluids or

TABLE 6

COMPARISON OF NITROGEN BALANCE IN POSTOPERATIVE PATIENTS DURING PERIOD OF NITROGEN NUTRITION BY VEIN (CASEIN DIGEST) WITH PERIOD OF PROTEIN NUTRITION BY MOUTH*

Patient	Period of Intravenous Injections of Casein Digest (5% Solution in 5% Dextrose)				Period of Nitrogen Ingestion by Mouth as Food Protein			
	No. of Days	Total Nitrogen Intake (Gm.)	Total Nitrogen Excretion (Gm.)	Average Daily Nitrogen Balance (Gm.)	No. of Days	Total Nitrogen Intake (Gm.)	Total Nitrogen Excretion (Gm.)	Average Daily Nitrogen Balance (Gm.)
I Lern	5	75	76	−0.20	4	60	56.[illegible]	+0.86
II Lek	5	75	64	+2.2	5	78	43.40	+6.72
III Frieb	4	60	61.94	−0.49	4	28.8	27.00	+0.45
IV Knaub	6	72	94.67	−3.72	6	72.0	62.14	+1.61
V Winn	4	60	68.37	−2.09	4	60.8	61.85	−0.26
VI Conif	5	45.75	48.70	−0.59	6	41	44.[illegible]	−0.[illegible]
VII Dyx	4	24	28.40	−1.10	4	23.2	31.00	−2.2
VIII Lett	5	75	74.2[illegible]	−0.16	5	75	49.21	+5.16
IX Hoox	5	3[illegible]	32.34	+0.73	5	23.[illegible]	21.[illegible]	+0.49
X Carls	5	15	[illegible]6.16	−10.23	5	13	50.34	−7.47
XI Horw	5	30	58.7	−5.74	5	[illegible]6.28	40.74	−2.89
XII Mur	4	48	4[illegible].88	+0.30	5	55.6	[illegible]0	−0.88

* The total caloric intake [illegible] each patient [illegible] period was comparable. During the period of intravenous injection of casein digest [illegible] requirement [illegible] was injected [illegible] During the period [illegible] ingestion by mouth [illegible] were [illegible] by the dietary [illegible] and [illegible]

food by mouth for several days With these patients the writer withholds all fluids by mouth for 3–5 days and then permits 30–45 cc of water an hour (12 hours) for 1 or 2 days 60–90 cc an hour the next day or two then liquid to regular diet is afforded gradually over a period of several days Where Levine tubes have been inserted past the sites of anastomoses liquid nourishment may be started shortly after operation

PREOPERATIVE AND POSTOPERATIVE CHEMOTHERAPY

Tremendous enthusiasm has developed in the past few years concerning the efficacy of chemotherapy by the sulpha drugs and penicillin At pres

ent this great enthusiasm remains unabated although local implantation of the sulpha drugs appears to receive less favorable consideration than it did a short time ago. It is not possible to determine at this time the true status of these drugs in connection with the prevention and treatment of infections incident to procedures such as those described in this treatise. Suffice it to state that the author has employed the agents postoperatively in most of the patients cited in this series. Deep and superficial wound infections have, nevertheless, developed in the incidence expected, and the impression at this writing is that in the type of surgery considered here little unequivocal evidence has been observed to indicate that they may have had an important beneficial influence. The role of these agents in the control of upper respiratory and urinary tract infections is undoubtedly an important one. Their actions in combating spread of the intra-abdominal infections, with possible prevention of eventual fatal septicemia in some instances, certainly remains to be more clearly evaluated.

Poth has recently reviewed the question of the preoperative use of certain sparingly soluble sulphonamides administered by mouth to alter the bacterial flora of the colon as an adjuvant measure in reducing the risk of peritonitis in surgery of the colon. Definite evaluation of their efficiency must await further and extensive trial, although preliminary impressions by the above author and others are indeed favorable.

The employment of constant gastric aspiration (Wangensteen) and aspiration of the alimentary tract lower down (Miller-Abbott tube) has become so well established and the advantages are so widely appreciated that there is no need here for discussion of these features of postoperative management.

CHAPTER V

TOTAL GASTRECTOMY, TRANSTHORACIC TOTAL GASTRECTOMY, CARDIOESOPHAGECTOMY

TOTAL GASTRECTOMY

TOTAL gastrectomy is now generally *regarded as a standard procedure* although it is not frequently carried out. In a review of 298 cases reported up to 1943, Pack and McNeer found the over-all operative *mortality to be 37.6 per cent (112)* cases. Of the cases reported in the earlier years (1884–1920) the mortality was 49 per cent. It is highly probable that the mortality was much higher since failures are usually not recorded. In a series of 73 personal cases of total gastrectomy performed by Lahey and reported in 1944 the *mortality was 33 per cent. Five year* survivals are indeed relatively few. The principal value of total gastrectomy is palliative in that the patients are relieved for varying periods of the distressing symptoms due to the cancerous stomach and their terminal periods are characterized by profound asthenia in which, however, pain is not an outstanding symptom. It would thus appear that total gastrectomy may well be performed, even though metastases that cannot be excised are present. It certainly is indicated where there is no gross evidence of metastases beyond the resectable nodes and even though the incisions to encompass the growth must be made close to the macroscopic borders of the tumor as in the following patient.

Case 4.—H. S. (273367), male, 50 years of age. Admitted December 12, 1941 complaining of constant epigastric distress, fatigue, and slight loss in weight, 1 year's duration. Barium fluoroscopy revealed a large polypoid lesion in the upper portion of *the stomach.* Gastroscopic examination revealed a large polypoid carcinoma in the upper anterior aspect of the stomach.

Total gastrectomy was performed on December 17, 1941 (Fig. 2); the spleen and most of the omentum were resected with the stomach. No hepatic metastases were observed. The incision transecting the cardia passed a few millimeters below the actual cardioesophageal junction and about 1½ *cm. above the upper gross* border of the carcinoma (Fig. 3). Histologic study revealed metastases in the lymph nodes of the lesser curvature and in nodes from the greater curvature and the omentum. See

tions also showed in the omentum many lymphatic vessels filled with carcinoma cells.

Convalescence was uneventful; nothing was permitted by mouth for 17 days, the patient receiving casein digest (Amigen), glucose and saline solution intravenously during this period. He was discharged on the thirty-second day after operation. Six months later x-ray therapy was given

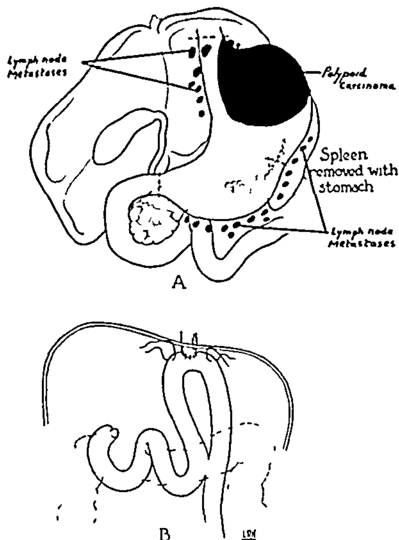


FIG 2 —Case 4 (273307) *A*, Diagrammatic representation of large carcinoma of upper portion of stomach with extensive lymph node metastases along greater and lesser curvatures; there were also numerous metastases throughout the omentum; no apparent hepatic metastases; transection of esophagus near tumor. *B*, after total gastrectomy and with resection of spleen and omentum; sutures inserted between diaphragm and jejunum on each side of anastomosis; enteroenterostomy below level of transverse mesocolon. Patient alive and well 4 years and 9 months after operation

to the region of the esophagojejunal anastomosis the total depth dose being 1 544 r This was a "prophylactic" measure because of the histologic findings mentioned above and was not given because of evidence of local recurrence

Four years and nine months after operation the patient is clinically well and engaged in a pursuit calling for heavy physical labor His weight

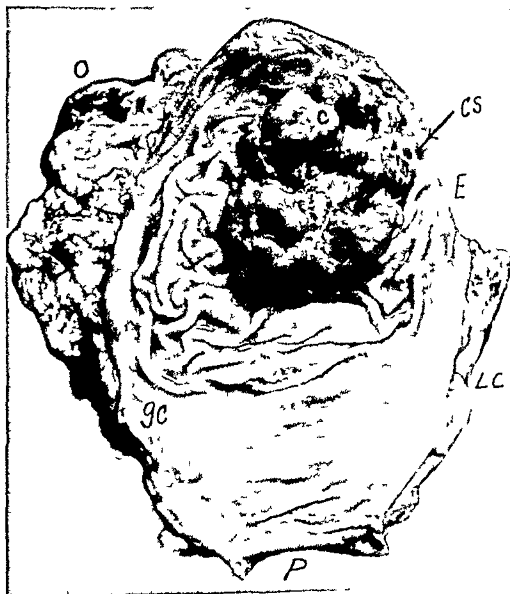


FIG 8 —Case 4 (273367) Surgical specimen (whole stomach) from operation depicted in Figure 2 Total gastrectomy performed *even though incisions passed very close to gross limits of tumor* C large carcinoma in fundus *P* pylorus *E* esophageal orifice *CS* gross limit of tumor 1 5 cm from esophageal transection *LC* lesser curvature *GC* greater curvature *O* omentum which contained numerous metastases Patient alive and well 4 years later

has been stabilized at 135–37 pounds for 2 years (highest preoperative weight was 152 pounds) He states that he feels better when eating a varied diet divided into eight to ten feedings a day than when he attempts to eat three or four meals a day Roentgenologic examination 1 year and 10 months after operation revealed that the loop of jejunum just distal to the esophagus had become dilated to simulate the stomach

The technique of total gastrectomy is now too well standardized to be repeated in detail here The author usually performs splenectomy with total gastrectomy This does not complicate the procedure but simplifies it After retraction of the stomach cephalad following transection of the duodenum and mobilization of the spleen from behind by division of the splenodiaphragmatic ligament a linen ligature is passed about the tip of the tail of the pancreas and includes the splenic artery and vein near the hilum of the spleen The latter is easily mobilized with the stomach after these vessels are ligated and the splenocolic ligament is divided The coronary ligaments of the left lobe of the liver are divided and this lobe is retracted to the right thus greatly facilitating exposure of the abdominal esophagus A clamp is applied across the cardia the stomach and spleen are retracted over the left costal arch and interrupted sutures are placed between the posterior aspect of the abdominal esophagus and the apex of the jejunal loop brought upward behind the transverse colon The stomach is then cut away and the anastomosis between esophagus and jejunum is completed also with interrupted sutures for the inner row Following this sutures are placed between diaphragm and jejunum on each side of the anastomosis (Fig 2) The latter is greatly facilitated if the peritoneum has been left over the anterior surface of the abdominal esophagus It is also facilitated if a cuff of gastric wall about 0 5–1 cm in width remains attached to the esophagus although under such circumstances the operation would not be strictly speaking a total gastrectomy A jejunojejunostomy is performed below the level of the transverse mesocolon between the afferent and the efferent loops of the jejunum going to the esophagojejunal anastomosis

Roscoe Graham modifies the technique of esophagojejunostomy as follows (Fig 4) The mobilized stomach (after transection at the junction with the duodenum) with clamp across the cardia is retracted downward to pull the abdominal portion of the esophagus over the anterior aspect of the elevated jejunal loop (beginning of the efferent limb) and is sutured to it Transection of the esophagogastric junction is performed with re

moval of the stomach A transverse incision is made in the jejunum and esophagojejunostomy is then carried out, with interrupted sutures An aspirating tube passed via the mouth or nose into the esophagus is pushed down into the jejunum just prior to completion of this anastomosis The upper portion of the afferent loop of the jejunum is then folded over the anterior aspect of the site of this anastomosis and sutured to the efferent loop Jejujejunostomy below the hiatus in the transverse meso

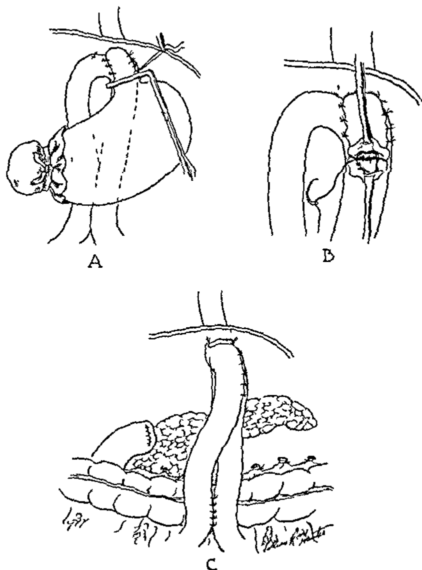


Fig 4—Diagrammatic representation of esophagojejunostomy according to Roscoe Graham following total gastrectomy A stomach retracted downward to permit suture of abdominal esophagus to efferent loop of jejunum B anastomosis with interrupted sutures C afferent loop of jejunum folded over anastomosis and jejujejunostomy below transverse mesocolon

colon is then performed and is necessary in this procedure inasmuch as the afferent loop of the jejunum is obstructed

The insertion of a Levine tube per os (or nose) into the esophagus and through the gastrojejunostomy into the efferent loop of the jejunum at the time of operation is frequently recommended as a routine procedure the tube to remain in place for 8–10 days The purpose of this is to protect the anastomosis and facilitate feeding into the jejunum The necessity for this procedure is not generally admitted since the tube may be a source of irritation and since in the experience of many operators satisfactory results are obtained without it

The advantage of the Roscoe Graham type of anastomosis as compared with the conventional end to side esophagojejunostomy is that the possibility of leakage is greatly reduced The procedure however requires more time and at the end of what might have been an extensive operation to mobilize a cancerous stomach and adjacent involved structures the time factor is an important one Some authors are of the opinion that the Graham type of anastomosis will substantially reduce the mortality of total gastrectomy but more extensive experience is necessary to settle this question

POSTOPERATIVE MANAGEMENT

The general principles of preoperative and postoperative management of patients subjected to extensive intra abdominal operations are discussed in chapter iv However the patients in whom the entire stomach has been removed present special features which will be discussed here Some surgeons permit these patients to take small quantities of fluid by mouth after the third or fourth day The writer does not permit fluid by mouth for 10 days following operation all fluid and nutriment being given parenterally On the eleventh day 30 cc of water are taken every hour for 12 hours the next day this may be increased to 60 cc On the twelfth day 60 cc of clear broths are permitted and on the subsequent days the hourly feedings include skimmed milk vegetable juices custards ice cream etc By the eighteenth to twentieth day small quantities of soft diet are taken Not infrequently these patients will complain of a sense of fulness or distention at times during the day and this necessitates temporary reduction in the diet As time goes on the patients learn to ingest the proper quantities of food at the proper intervals finally taking four or five meals a day Eventually the upper loop of jejunum just distal to the anastomosis with the esophagus dilates to simulate the stomach

It is generally held that totally gastrectomized patients are capable of normal assimilation of proteins carbohydrate, and fat They are capable of gaining and maintaining weight but do not achieve the weight presented before the development of symptoms that led to total gastrectomy The studies of *Reker et al suggest that in* some of these patients there may be disturbances in fat and protein absorption that have hitherto not been appreciated Such metabolic studies should be carried out in larger numbers of *patients and might lead to an explanation of the* inability to regain maximal weight

There has been considerable discussion in the past concerning the development of pernicious anemia following total gastrectomy It now appears that this is indeed a rare sequela Among 53 previously totally gas-

TABLE 7

Patient	Time After Total Gastrectomy for Carcinoma (In Months)	R B C	Hb
1 Swar (35268)	21	3 300 000	65%
2 Qua (251259)	40	3 990 000	13 5 gm
3 Sack (273367)	30	4 160 000	13 6 gm
4 Rud (298043)	12	4 010 000	14 gm
5 Brew (295659)	5	3 020 000	11 gm

trectomized patients reviewed in the literature by Pack and McNeer 27 were found to have erythrocyte counts of less than 4 000 000 Among the latter only 7 exhibited a hyperchromic type of anemia In Lahey's series of 12 patients surviving 1–5 years after operation no instance of primary anemia was encountered In Table 7 are listed 5 patients who had total gastrectomy and were observed in the *University of Chicago Clinics,* showing their erythrocyte counts (there had been no antianemic therapy)

While pernicious anemia as stated appears to be a rare late complication these patients often exhibit secondary anemia In the series shown in Table 7 secondary anemia was pronounced in two instances (Cases 1 and 5) Ferris *et al* attribute this to the absence of hydrochloric acid in the gastric juice which in the normal subject converts inorganic iron in the diet to the absorbable ferrous form and they *recommend 0 32 gm of* ferrous sulphate three times a week each month While this therapy is indicated for secondary anemia (and some also recommend liver extract) the cause *of the anemia cannot* be ascribed to lack of acid gastric juice

since patients with natural achlorhydria of many years' duration do not invariably develop profound secondary anemia

CARCINOMA OF THE ESOPHAGOGASTRIC JUNCTION

Carcinomas at the esophagogastric junction until recent years were generally regarded as inoperable because of location rather than because of size. However, now that cardioesophagectomy has proved to be feasible (Phemister and Adams), neoplasms in this region should be excised when encountered even when local spread or metastases are present but not too extensive. A patient subjected to cardioesophagectomy for carcinoma by Phemister and Adams has survived for 8 years even though an excised node near the esophagogastric junction exhibited metastases. In the event of spread to neighboring lymph nodes the degree of palliation obtained by relief of obstruction and the obviation of hemorrhage justify the procedure.

Cardioesophagectomy is performed via the thoracic (left) approach to the site of the neoplasm (Figs. 5 and 6). This approach to gastric neoplasms, however, does not entail greater risks than the conventional abdominal approach when only the left thoracic cavity has been opened.

The size of the neoplasm involving the upper stomach and lower segments of the esophagus does not in itself preclude attempts at excision in view of recent experiences in the surgery of this region. In the following patient, although he did not survive, the technical features are of interest in illustrating the extent of the resection.

Case 14.—Kuch (39910), 58 years of age. Admitted to the hospital complaining of dysphagia, loss of appetite and loss of 50 pounds weight in one year. There was considerable variation in the relative difficulty in swallowing solid and liquid food. Roentgenographic study revealed evidence of a neoplasm of the esophagus extending from just below the arch of the aorta downward to involve the upper fourth of the stomach. There was no evidence of pulmonary metastases. Physical examination was negative except for "pulmonary osteoarthropathy" in the digits of the hands.

SUBTOTAL THORACIC ESOPHAGO-PARTIAL GASTRECTOMY AND SPLENECTOMY (FIG. 7)

Operation was performed on February 26, 1944, under positive pressure ethylene-oxygen anesthesia. The patient was placed on the right side with the left arm abducted. The thorax was entered after resection of the eighth rib. The seventh and sixth ribs were fractured near the vertebral column to increase exposure. The left phrenic nerve was crushed, the left pulmonary ligament incised and the left lung retracted upward. The medi-

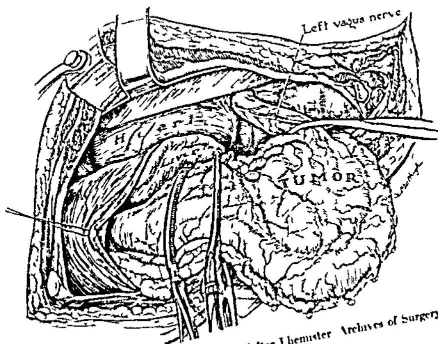
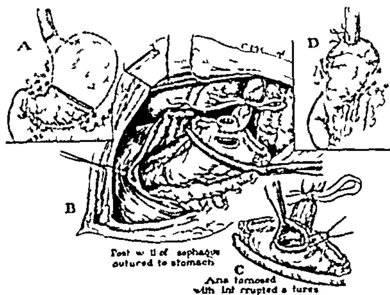


Fig 5 —Transthoracic cardioesophagectomy (after Phemister Archives of Surgery 46 915 9 1943)



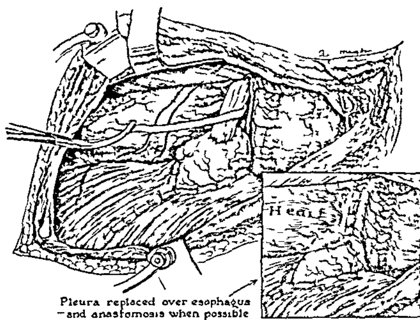


Fig 6—Transthoracic cardioesophagectomy (after Phemister Archives of Surgery 46 915–29 1943)

astinal pleura over the lower esophagus was incised, and the latter, enlarged to a fusiform mass, was mobilized, not, however, without perforating the right mediastinal parietal pleura. The dome of the left diaphragm was incised and the incision was carried to the esophageal hiatus. It was now apparent that carcinoma extended below the diaphragm to involve the upper quarter of the stomach. Exploration of the upper abdomen failed to reveal metastases. The right and left gastric arteries were divided, the splenic vessels were ligated and divided, and the spleen was resected. The left gastroepiploic artery and vein were left intact. The upper stomach was further mobilized by transection of peritoneal reflections to the upper posterior abdominal wall. Straight rubber covered intestinal clamps were

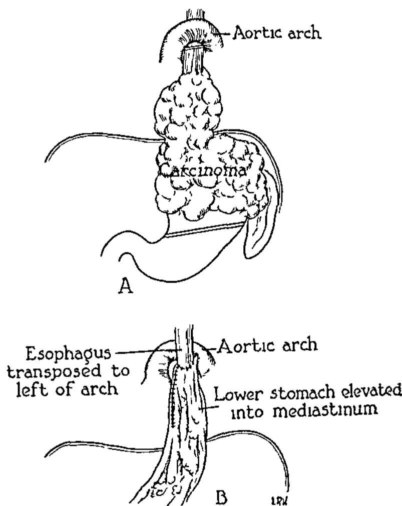


FIG. 7.—Case 64 (327910). A showing carcinoma of upper portion of stomach extending to involve lower third of esophagus. *B* after transthoracic partial gastrectomy and subtotal thoracic esophagectomy with transposition of upper esophageal stump to left of aortic arch.

applied obliquely across the stomach dividing the upper third from the lower two thirds The obliquity was from high on the left downward toward the lesser curvature The lower segment of stomach was closed by two layers of continuous sutures A gauze sponge was tied over the cut edge of the upper segment The esophagus was mobilized to the level of the aortic arch and transected with removal of the tumor bearing portions The small stump of esophagus was then brought over the arch of the aorta to its left side (Fig 7) The stomach was brought upward and a gastroesophageal anastomosis made at a point anterior to the suture line on the stomach and a few centimeters below the highest point on the fundic region Two concentric rows of interrupted silk sutures were employed for the anastomosis Several interrupted sutures were placed between the upper portion of the stomach and the mediastinal pleura to relieve tension at the anastomosis (which however was negligible even before these sutures were inserted) The omentum was not resected from the greater curvature of the stomach It was sutured onto the left mediastinal pleura to aid in sealing the mediastinal space Interrupted sutures were placed between the stomach wall and the edges of the diaphragmatic wound and the latter was also completely closed A Pezzar catheter was inserted through a stab wound in the ninth intercostal space and the wound in the thorax was closed The surgical specimen is shown in Figure 8 Histologic study showed adenocarcinoma (gastric origin)

The immediate postoperative course was satisfactory Continuous suction was applied to the Pezzar catheter in the left thorax and serohemorrhagic fluid was withdrawn (600 cc in 24 hours) Oxygen was given by nasal tube In the afternoon of the second day the temperature rose to 104° F (rectal) the pulse was 140 per minute At about 2 00 A M the morning of the third day the blood pressure fell from 150/72 to 70/40 the pulse to below 50 (fibrillation) two plasma transfusions were given (total 500 cc) dyspnea became rapidly more pronounced and the patient died at 9 00 A M

Necropsy revealed massive atelectasis of the right lung and partial atelectasis of the left lung there was thick tenacious mucus in the smaller bronchi The right pleural cavity contained 1 600 cc of blood tinged fluid and there were 400 cc of similar fluid in the left pleural cavity *There was no evidence of carcinoma anywhere* The gastroesophageal anastomosis was sealed and there was no evidence of infection about it

In retrospect aspiration of the right chest cavity on the second day



Fig. 8.—Case 61 (3[illegible]7910). Surgical specimen from transthoracic subtotal esophagectomy-gastrectomy for large carcinoma involving lower third of esophagus and upper one fourth of stomach. White arrow indicates level of esophagogastric junction. The esophagus was transected at the arch of the aorta, and the upper esophageal stump was brought over the arch to the left; esophagogastric anastomosis was carried out after extensive mobilization and elevation of lower two-thirds of stomach into upper mediastinum.

might have been beneficial or possibly an insertion of another Pezzar catheter to which continuous suction was applied might have afforded a more fortunate outcome

The presence of the stretched out stomach in the mediastinum does not afford a condition which per se leads to pulmonary embarrassment because of possible compression The author resected the major portion of the esophagus in a male patient for carcinoma in the middle third the upper esophageal stump was brought over to the left of the arch of the aorta and the stomach was elevated for esophagogastrostomy above the level of the aortic arch The patient survived in comfort for over a year and died of metastases

Accidental tearing of the right mediastinal pleura with entrance of air into the right thorax which may occur during the isolation of a neoplasm of the cardia which has extended upward on the esophagus and which is being attacked by the left transthoracic approach constitutes a grave complication but by no means an irremediable one The attempt is made to repair the tear but if this cannot be done readily resection of the lesion proceeds The stomach when elevated into the thorax may be sutured over the region of the tear Return of the left lung to its normal position from high retraction in the left chest may also aid in occluding the communication between right and left pleural spaces If not the left thorax is closed after a Pezzar catheter is inserted through a stab wound in the lower chest wall While the patient is still under anesthesia (positive pressure) suction is applied to the catheter to exhaust the air in the thoracic cavity (both sides if communication persists) and a chest suction apparatus is immediately set up to the catheter

In three other patients transthoracic partial gastroesophagectomy with splenectomy was carried out for large inoperable carcinomas of the upper end of the stomach involving the lower end of the esophagus There were extensive lymph node metastases about the stomach in the upper retroperitoneal spaces and about the aorta In neither instance were hepatic metastases visible or palpable In one of the patients—Case 70 KJ (339975) a white male 62 years of age—the left margin of the esophageal hiatus of the diaphragm was invaded and this was resected with the upper half of the stomach and the lower 6 cm of esophagus and mediastinal lymph node metastases (Fig 9) The patient succumbed on the third day necropsy revealed extensive thrombi in the small vessels along the attachment of the small and large bowels to their mesenteries and de

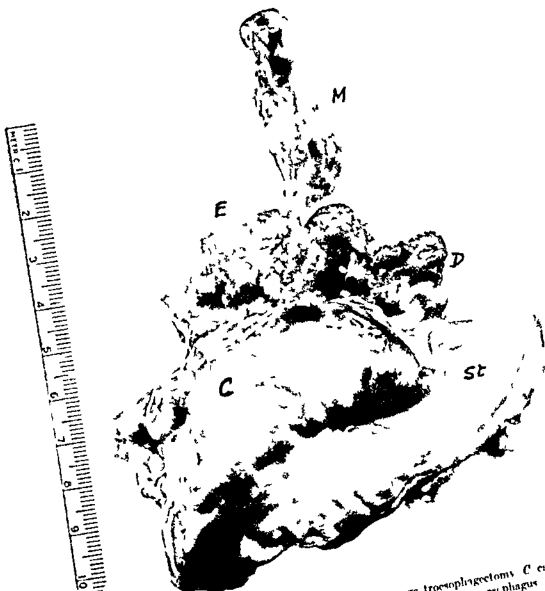


Fig 9.—Case 70 (339975) Surgical specimen obtained from gastroesophagectomy *C* carcinoma involving cardia of stomach and lower esophagus *E* transected lower thoracic esophagus *St* upper end of stomach *D* diaphragm of left margin of esophageal hiatus infiltrated by carcinoma and resected with tumor *M* mediastinal metastatic lymph nodes resected with specimen from anterior aspect of thoracic aorta Operation terminated by gastroesophagostomy Immediate reaction satisfactory Patient died suddenly on third day Necropsy revealed multiple thrombi in small veins at mesenteric attachment of bowels and ischemic necrosis of remaining portion of stomach

vitalization of the upper portion of the stomach brought upward through the diaphragm In the second patient—Case 60 Wil (126132), a white male 58 years of age—there was extensive invasion of the dome of the left diaphragm and the body of the pancreas by a tumor from the stomach This necessitated resection en masse of the mid portion of the diaphragm with the upper half of the stomach the body and tail of the pancreas and the lower 5 cm of the esophagus (Fig 10) Repair of the diaphragm was later carried out by a shift of the flaps remaining on each side During mobilization of the stomach neoplastic extensions onto the abdominal aorta were partially resected and the aorta was accidentally opened This tear was repaired and the esophageal gastric anastomosis completed The patient seemingly recovered from the operation but collapsed suddenly and died a short time after return to his room Necropsy was not performed The cause of death was probably internal hemorrhage (from the wound in the aorta?) In the third patient—Case 88 K (348610) a male 52 years of age who had lost 40 pounds weight in 10 months—the upper two thirds of the stomach and the lower 6 cm of the esophagus together with the spleen and the body of the pancreas were resected (Fig 11) Convalescence was satisfactory and ingestion of food by mouth not possible prior to operation was again facilitated the patient enjoying his meals and gaining weight He lived 9 months returning to work for several weeks later dying of widespread metastases

TRANSTHORACIC TOTAL GASTRECTOMY

Carcinoma involving the major portion of the stomach and extending upward on the esophagus above the diaphragm cannot be entirely resected via the abdominal approach In such instances total gastrectomy is performed via the thoracic approach The first successful transthoracic total gastrectomy was performed by Willy Meyer of New York in 1942 and more recently R H Sweet has reported 7 instances of transthoracic total gastrectomy with immediate mortality in 2 instances both due to sepsis The latter author describes (Fig 12) a procedure for advancing the loop of the jejunum into the thorax for esophagojejunostomy This loop is pulled upward as far as possible and the restraining mesenteric vessels are noted Division of the ligament of Treitz may facilitate additional elevation If this is not sufficient the restraining artery and its veins are isolated divided and ligated Great care is exercised to prevent injury to the collateral vascular arches The above step has facilitated as much as



Fig 10 —Case 69 (196,132) Transthoracic esophagogastrectomy and resection of left dome of diaphragm Photograph shows posterior aspect of surgical specimen consisting of *St* upper half of stomach—with *C* large carcinoma *E* transected esophagus 5 cm above diaphragm *P* body and tail of pancreas invaded by neoplasm *D* dome of left diaphragm also invaded by carcinoma *Sp* spleen



Fig 11 — Case 88 (318010) Surgical specimen consisting of upper two-thirds of stomach S and lower 6 cm of esophagus E resected for large high gastric carcinoma C. The spleen Sp and distal portion of the body of the pancreas P were also resected. The patient received palliation, living for months, and was able to ingest a general diet by mouth.

6 cm additional elevation of the jejunal loop This is of great importance since lack of tension at the anastomosis is necessary to avoid separation

In most of Sweet's patients a small portion of pancreas was of necessity, resected with the stomach The spleen was also removed in every instance The following patient is an example of transthoracic total gastrectomy with resection of local extensions for carcinoma of the stomach

Case 71 —Ash (355031) white male 65 years of age Admitted to the hospital because roentgenographic study elsewhere had demonstrated a large carcinoma of the upper end of the stomach and the lower esophagus as the cause of progressive dysphasia of several months duration He was operated upon under positive pressure general anesthesia as follows

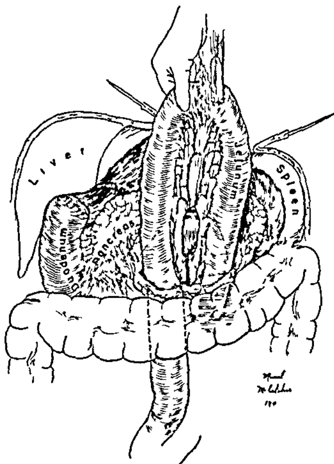


Fig 12 —Diagrammatic illustration of Sweet's procedure for *advancement of loop* of jejunum for anastomosis with esophagus in transthoracic total gastrectomy where carcinoma has extended some distance into lower esophagus The restraining vessels are ligated and divided with preservation of vascular arches nearer bowel wall to maintain circulation (after Sweet Annals of Surgery 18 810-30 1943)

TRANSTHORACIC TOTAL GASTRECTOMY, SPLENECTOMY, AND RESECTION OF BODY OF PANCREAS WITH UPPER RETROPERITONEAL TISSUES

1 Patient was placed on his right side, the left arm abducted

2 An oblique incision was made over the ninth rib to exposure and resection of the rib with entrance into the thoracic cavity Spread of the eighth and tenth ribs was effected by an automatic retractor

3 *The left lung was retracted upward after division of the left pulmonary ligament*

4 An incision was made into the left mediastinal pleura over the lower esophagus, the lowest 3 cm of which exhibited invasion from below by carcinoma

5 Incision through the dome of the left diaphragm was carried out and this incision extended to the esophageal hiatus centrally and almost to the costal arch peripherally

6 Inspection and palpation revealed a large carcinoma involving the upper half of the stomach with extension backward onto the mid portion of the body of the pancreas There was a number of enlarged and firm lymph nodes along the lesser curvature in the gastrohepatic omentum and about the body of the pancreas There were no liver metastases

7 *The spleen was mobilized by division of its ligaments to the diaphragm and to the colon*

8 The pylorus was transected and invaginated with considerable difficulty The lower stomach with adherent nodes was mobilized

9 The spleen was elevated to the right and this also elevated the body and tail of the pancreas with the splenic vessels The peritoneal reflections to the posterior gastric wall with enlarged and firm retroperitoneal nodes and the surrounding tissues were also freed with the body of the pancreas and the stomach

10 The neck of the pancreas was ligated with linen, this included the splenic artery and vein, the latter were divided

11 The entire stomach, the body of the pancreas, the spleen, and the adherent retroperitoneal tissues and metastatic nodes were brought upward into the thorax The esophagus was divided about 6 cm above the level of the diaphragm

12 The first long loop of the jejunum was brought upward Tension was relieved by transection of the ligament of Treitz and it became evident that anastomosis with the esophagus would be possible without division of vessels in the mesentery of the jejunum Esophagojejunostomy was

then performed according to the method of Roscoe Graham (previously described), and enteroenterostomy was carried out below the level of the transverse colon. The mediastinal pleura was closed over the esophago-jejunal anastomosis, with sutures between jejunal loops and this pleura to support and fix the anastomosis.



FIG 13.—Case 71 (355031). Surgical specimen obtained from transthoracic operation depicted in Figure 12 and consisting of entire stomach (*St*) with (*C*) massive carcinoma in upper half, which extended upward into esophagus for 3 cm. *E*, transected esophagus; *TE*, neoplasm extending into esophagus; *Sp*, spleen. Body and tail of pancreas with multiple metastases in gastrohepatic omentum, also resected en masse with above, are not seen in photograph as they are on opposite side of specimen. Patient died on tenth day of peritonitis due to perforation (ischemic) of first portion of duodenum near site of invagination of duodenal stump. At necropsy there was no gross evidence of residual carcinoma.

13. The incision in the diaphragm was closed with interrupted sutures between the edges at the esophageal hiatus, the loop of the jejunum passing through the latter.

14. The wound in the chest wall was closed with a Pezzer catheter in a stab wound in the tenth interspace to drain the left thoracic cavity.

Study of the surgical specimen confirmed the fact that the entire stomach, the lower 6 cm of the esophagus, the body of the pancreas, the

spleen and the upper retroperitoneal tissues had been removed en masse (Fig 14 a) When the stomach was opened a large ulcerating raised carcinomatous mass was found involving the upper two fifths and encircling the entire organ It had spread onto the anterior surface of the body of the pancreas by direct invasion When incised the mass was found to be necrotic The numerous enlarged lymph nodes also exhibited necrotic centers The neoplasm had extended about 3 cm up the esophagus and

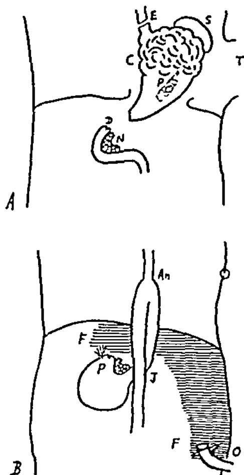


Fig 14 —Case 71 (355031) A diagram of total gastrecto-partial esophago-pancreato-splenectomy performed via left transthoracic route T–C large carcinoma of upper portion of stomach involving lower esophagus F plane of transection of esophagus S spleen P body and tail of pancreas invaded by cancer D invaginated duodenal stump N transected neck of pancreas

B situation at necropsy 10 days after operation P minute perforation in obstructed duodenum loop of jejunum drawn upward with production of obstruction of duodenum at J Intact esophagojejunostomy An F–F left subdiaphragmatic and left flank abscess drained previously at O in left lateral abdominal wall

the esophageal transection was wide of the tumor. Histologic study revealed adenocarcinoma.

The patient's condition appeared satisfactory for several days following operation, except for rectal temperatures that became as high as 105° F on the evening of the second day; later the temperature fell to 100°–101° F. Clinical and roentgenographic examinations of the chest were repeatedly negative. On the eighth day rigidity and fluctuation developed in the left abdomen. Under local anesthesia a stab wound was made in the left lower quadrant with liberation of purulent, bile stained fluid having a fecal odor (Fig. 14). A rubber tube drain was inserted. It was apparent that a perforation in the small bowel had occurred. Because his condition was fair and sounds were heard over the abdomen, no further laparotomy was contemplated. On the tenth day he became suddenly worse; at 7:00 P.M. he failed to respond, and on the morning of the eleventh day he died.

Necropsy revealed an extensive right subdiaphragmatic abscess, well walled off, which had extended over the excision site into the left peritoneal gutter and downward into the pelvis. The stab wound with rubber tube drain led into the lower left peritoneal gutter. This abscess, also containing material from the small bowel, was "fed" from a small perforation in the first part of the duodenum 2 cm. from the point of invagination. The entire duodenum was markedly dilated, owing to obstruction of the terminal portion by the sharp upward drag of the vessels in the mesentery of the loop of jejunum that had been elevated for esophagojejunal anastomosis. The latter anastomosis, as well as the jejunojejunostomy, were tight, and there was no evidence of infection in the mediastinum or left thorax. *Thus the fatality might have been avoided if the loop of jejunum brought upward in the thorax had been more relaxed* (as could possibly have been obtained by the procedure of R. H. Sweet described above).

ANESTHESIA IN TRANSTHORACIC GASTROESOPHAGECTOMY

It is obvious that in these types of operations the services of expert anesthetists are indispensable. General anesthesia with ethylene ether or nitrous oxide–ethylene ether is administered with apparatus for positive pressure. As soon as the thorax is opened, positive pressure anesthesia is begun. The positive pressure is gauged to obtain maximal physiologic expansion of the lungs to assure maximal respiratory exchange and oxygenation under the conditions. When the thorax is opened and the ribs retracted, the surgeon inspects the left lung prior to further steps in the

operation in order to check with the anesthetist on the amount of positive pressure that is being given. Overdistention as well as insufficient expansion is corrected by varying the degree of positive pressure. During the operation the anesthetist varies the degree of positive pressure as necessity demands.

EXPLORATORY LAPAROTOMY IN THE FACE OF ROENTGENOGRAPHIC AND GASTROSCOPIC EVIDENCE OF INOPERABLE GASTRIC CANCER

Although roentgenographic diagnosis of gastric neoplasms has been developed to a high degree of proficiency and can now be complemented by gastroscopy, surgical exploration of the abdomen should not be omitted in some patients who might appear to have far advanced inoperable neoplasms diagnosed by the above procedures unless there is other corroborative clinical evidence of extensive spread, such as pulmonary metastases or metastases in the left lower cervical nodes proved by biopsy, or extensive periumbilical subcutaneous metastases in the abdominal wall, or ascites in which fluid carcinoma cells may be identified after centrifugation.

Not infrequently the actual findings at laparotomy reveal a neoplasm to be smaller than anticipated by roentgenographic and gastroscopic examination and the condition is discovered to be operable. Indeed, lesions thought to be carcinoma may prove not to be neoplastic at all. The following is a case in point.

G. W. (253391), female, 53 years of age. Admitted December 31, 1940, complaining of intermittent epigastric pain relieved by food, of 8 years duration; loss of appetite, 1 year; 20 pounds loss in weight, 1 year; constipation, 2 years. Previous examination elsewhere had led to the diagnosis of peptic ulcer, and medical management had been instituted. This afforded little relief, and two years previously in another institution a gastroenterostomy had been performed, also with little symptomatic improvement.

Seventeen years previously the diagnosis of pulmonary tuberculosis had been made and there had been a period of sanatorium treatment. In recent years there had been no cough or hemoptysis. In 1937 roentgenograms of the chest revealed tuberculosis.

Physical examination revealed an emaciated subject weighing 95 pounds, but not acutely ill. The abdomen was scaphoid and no masses could be palpated; there was considerable tenderness in the epigastrium.

Roentgenographic study was reported as follows:

1. Advanced pulmonary tuberculosis. 2. Ulcerating infiltrating carcinoma of the stomach. ... presence of pulmonary tuberculosis raises the possibility of a gastric tuberculosis but roentgenologic findings are those of (gastric) carcinoma.

Gastroscopic examination was performed by a gastroscopist of wide experience and was reported as follows: "Huge carcinoma (Type IV) originating on the anterior wall and lesser curvature extending up to cardia. I believe that this carcinoma will prove not to be resectable without going through the esophagus itself."

The medical consultant an experienced gastroenterologist made the following comment It is possible although not probable that a *resection was done rather than gastro*-enterostomy [in another institution] and that the malignant growth has since occluded the distal half of the stomach *In any event I have no doubt that* carcinoma was present in 1938 It is even possible that carcinoma was present at the onset of symptoms eight years ago

On December 13, 1940 laparotomy was performed through a high mid line incision Extensive adhesions were encountered in the upper abdomen *and these were divided In the posterior wall of the lower portion of the* stomach there was a large indurated mass in the center of which a crater could be palpated through the anterior gastric wall There were dense ad*hesions to the anterior aspect of the body of the pancreas and to the under* surface of the left lobe of the liver The liver itself appeared normal and there was no evidence of metastases The perigastric lymph nodes were enlarged but not 'stony hard' The *gastroenterostomy* was exposed and appeared well healed and surrounded by dense adhesions In view of the lack of hepatic metastases and the absence of peritoneal nodules it was concluded that the lesion was a penetrating ulcer and not a carcinoma The gastroenterostomy was taken down and the gastric and jejunal stomata were closed by two rows of sutures The lower three fourths of the stomach was then isolated except for adhesions to the liver for resection Considerable difficulty was encountered during the mobilization of the stomach because of dense *adhesions to the pancreas the latter were di*vided A portion of liver about 4 cm in diameter and 0 5 cm in thickness was cut away as it was adherent to the stomach and was mobilized with the latter *The raw surface of the liver* was closed by a continuous suture A Polya type (posterior) gastrojejunostomy was performed about 12 cm distal to the site of the previous anastomosis in the jejunum An entero enterostomy was performed below the hiatus in the transverse mesocolon and the latter was then sutured to the stomach

The surgical specimen revealed the *ulceration which penetrated* onto the liver and was situated on the posterior gastric wall and lesser curvature to measure 5 cm in length and 2–2½ cm in width the mucosal rugae *about it were thrown into* coarse polypoid folds Histologic section re vealed the lesion to be a large peptic ulcer there was no evidence of car cinoma

Convalescence was uneventful and the patient was discharged on the nineteenth day postoperative with recommendation that she remain un*der observation at her home in* another city because of extensive pul monary lesions

Three years later she returned to the outpatient department, complaining of "sour stomach" and epigastric pain of 3 weeks' duration. Roentgenograms revealed what appeared to be a new ulcer crater on the lesser curvature high up near the cardiac orifice. There was no evidence of stoma ulcer. She was hospitalized on the medical service and after improvement on medical management was discharged.

As stated at the beginning of this chapter, total gastrectomy is an operation performed essentially for palliation and the great majority of patients surviving eventually succumb from recurrences. Prolonged survivals may obtain in exceptional circumstances. Several reports dealing with survivals from total gastrectomy are cited below.

LACK AND McNEER	298 case reports in the literature up to 1944	
	16 survivals for three or more years	
	5 lived 3–4 years 2 lived over 4 years 2 lived 6 years	Patients that had died
	3 living 3–4 years 3 living over 4 years 1 living 8 years	Patients living at time report was made
WALTERS *et al* MAYO CLINIC 1907–38	27 patients operated upon	
	9 survived operation	
	8 died of recurrences	
	2 lived 1 year 2 lived 2 years 3 lived 3 years 1 lived 4 years 1 living 2 years	
LAHEY 1944	73 patients operated upon	
	24 operative deaths	
	3 living 1½–2 years 1 living over 2 years 1 living over 3 years 1 living over 4 years 1 living over 5 years	
UNIVERSITY OF CHICAGO CLINICS	29 patients operated upon 1928–44 (simple total gastrectomy with splenectomy in some instances)	
	14 operative deaths	
	1 living 1 year 1 living 3 years 1 living 3½ years (leiomyosarcoma) 1 living 4 years	

In Sweet's report of nine cases of transthoracic total gastrectomy, published in 1943, there were two postoperative deaths The above mentioned *patient (Case 71) who received* transthoracic total gastrectomy with excision of the spleen the body and tail of the pancreas, and the retroperitoneal tissues succumbed 10 days later as a result of an accident not related to the previous presence of neoplasm This patient was cited to illustrate the magnitude of a surgical procedure of this type that can be tolerated In connection with the more conservative cardioesophagectomy for carcinoma at the lower end of the esophagus or upper end of the stomach, the following are the results in 10 cases cited by Phemister

4 postoperative deaths
2 living 1–2 months
1 lived $3\frac{1}{2}$ months cause of death not determined
1 died of recurrences $1\frac{1}{4}$ years after operation
1 living and well $1\frac{3}{4}$ years after operation
1 living over 6 years after operation

The necessity for total gastrectomy in a patient indicates failure to obtain proper diagnosis and treatment early in the evolution of the neo*plasm*

As a palliative procedure, the results of total gastrectomy should improve with increased experience and efficiency of supportive treatment The operation should be performed without hesitation, even when the incisions for resection must pass close to the gross limits of the tumor as in Case 4 cited above, who has survived almost 5 years and remains well

CHAPTER VI

OPERATIONS FOR GASTRIC CARCINOMA THAT HAS EXTENDED TO NEIGHBORING VISCERA

Carcinoma of the stomach may involve the liver or the pancreas by direct infiltration while discrete hepatic metastases or extensive peritoneal spread are not apparent. Direct extension to involve the transverse colon may result from invasion downward and forward into the transverse mesocolon. In the latter patients gastrectomy is performed in the usual manner with the involved segment of colon also liberated and left attached to the portion of the stomach to be removed. The continuity of the colon is re-established by end-to-end anastomosis or a "Mikulicz type of resection is done bringing resected portions of stomach and colon out through the laparotomy wound applying clamps to segments of afferent and efferent loops to produce an obstructive resection." Such operations have been repeatedly performed and are not of sufficient rarity to cite specific instances here.

When the liver is involved by direct extension it is usually the undersurface of the left lobe because of its anatomical relationship to the stomach. The involvement usually constitutes adhesion to Glisson's capsule or possibly actual invasion of the parenchyma of the liver. The latter is unusual since Glisson's capsule is an effective barrier. In case of the former separation by traction or dissection would undoubtedly result in some neoplastic cells remaining adherent to the capsule. Inasmuch as resection of the left lobe or portions of it en masse with the gastric carcinoma is feasible this is preferable to simple gastric resection after freeing the growth by dissection from the liver. An example follows.

Case 3.—N. A. (#61810) white male 68 years of age. Admitted May 11, 1941, complaining of regurgitation of food and vomiting for the previous 1½ years with 40 pounds loss in weight. Examination revealed an emaciated subject with a rounded palpable mass in the left upper quadrant. Roentgenologic examination revealed a large polypoid carcinoma in the mid portion of the stomach.

Laparotomy was performed on May 20, 1941.

HEPATOGASTRECTOMY (FIG. 15)

1. An upper mid line incision was made. A large carcinoma arising in the lower portion of the stomach and directly invading the undersurface

of the left lobe of the liver, was observed There were no apparent discrete hepatic or peritoneal metastases

2 Ligation of the right gastric artery and vein and transection of the pylorus with invagination of the duodenal stump, were carried out

3 The portion of the left lobe of the liver just to the left of the falciform ligament was grasped firmly by the left hand—thumb on under surface of the lobe fingers on diaphragmatic surface The hepatic parenchyma was incised with the scalpel in a plane parallel to the falciform ligament The left hepatodiaphragmatic ligament was transected Continued compression with the left hand prevented hemorrhage from the cut

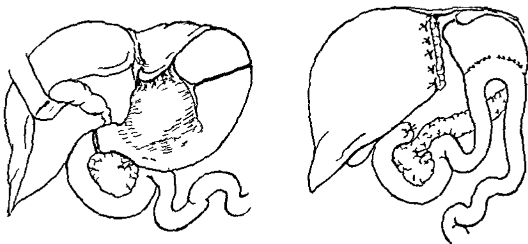


FIG 15 —Case 3 (261816) Schematic representation of radical gastrectomy and resection of left lobe of liver for carcinoma of stomach adherent to undersurface of left lobe Patient well and at work 4½ years after operation

hepatic surface With a large round curved needle interlocking mattress sutures of No 2 chromic catgut were placed along the cut hepatic surface and tied by the assistant to compress firmly the hepatic parenchyma (If tied too tightly such sutures will cut through the tissue and defeat their purpose of hemostasis) The large vessels and the bile ducts were clamped and ligated separately

4 The cancerous stomach together with the adherent left hepatic lobe was elevated and radical gastrectomy was performed according to the standard posterior Polya technique

5 Closure of the abdomen was made without drainage

Study of the specimen revealed it to consist of the lower portion of the stomach measuring 17 cm along the greater curvature with carcinoma arising in the lower posterior wall and invading the capsule on the under

surface of the left lobe of the liver Histologic study revealed adenocarcinoma of the stomach

Convalescence was uneventful and the patient was discharged on the eighteenth day In a few weeks he returned to work as a toolmaker in a furniture factory and 5½ years after the operation was still at work eating normally and presenting no complaints He has gained 20 pounds in weight

In another patient Case 100 (149882) subjected to exploratory laparotomy because of large upper abdominal mass a relatively small pyloric carcinoma was discovered with large hepatic metastases When the abdomen was opened the enlarged liver protruded forcibly through the wound and several of the metastases became fissured resulting in copious hemorrhage In order to arrest the latter the bleeding hepatic metastases were rapidly excised with suture of the liver and limited partial gastrectomy was performed for the primary growth The patient succumbed on the following day Had there been no hemorrhage from the metastases the operation would have been limited to exploration only but the above-described procedures were carried out in an attempt to arrest the hemorrhage Repeated attempts to arrest the hemorrhage by the insertion of mass sutures into the soft metastases had failed

Extensive carcinomas of the stomach as pointed out may infiltrate the posterior parietal peritoneum over the body of the pancreas without actual invasion of the latter Such extensions render the stomach relatively fixed upon initial examination However by transection of the gastrocolic omentum and then vertical incision of the peritoneum over the proximal portion of the body of the pancreas and the insertion of a large hemostat or scalpel handle between the pancreas and the overlying peritoneum in the direction of the spleen invasion of the pancreatic parenchyma itself may be determined Where only the peritoneum is invaded the latter may be easily elevated from the surface of the pancreas and resected with the stomach (Fig 16 Case 62 [322790])

Carcinoma of the lower pylorus may extend into the head of the pancreas In this situation pancreatoduodenectomy is performed in one stage as for carcinoma primary in the head of the pancreas This procedure is discussed in detail in chapter xi Figure 17 shows the surgical specimen from Case 93 (349868), a forty nine year old male who received radical one stage pancreatoduodenectomy because of a low pyloric carcinoma that had infiltrated into the head of the pancreas The symptoms were

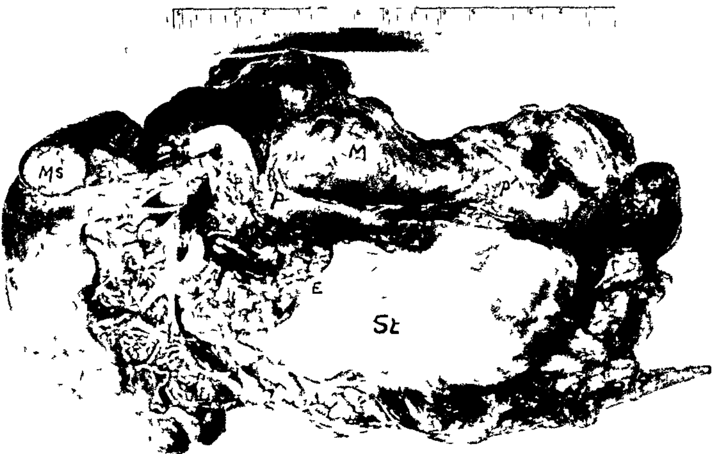


Fig 18.—Case C2 (322700) Anterior view of surgical specimen consisting of *St* entire stomach and spleen resected for carcinoma of the former. Extensive lymph node metastases *M* in gastrohepatic omentum. *MS* metastasis in spleen. There was adhesion of the cancerous stomach to the peritoneum over the body of the pancreas and this was elevated from the pancreas and resected en masse with the above. *P-P'* parietal peritoneum over body of pancreas with *P* ... distal portion of body of pancreas resected with the specimen.

those of pyloric obstruction with marked anemia due to hemorrhage from the lesion. In this instance there was no obstruction of the common bile duct and hence the latter was not dilated. After resection of the lower stomach, the duodenum and the head of the pancreas, together with re-



FIG 17 —Case 93 (319868). Surgical specimen consisting of *S* lower pylorus with *C* carcinoma that had extended into head of pancreas. *V* large thrombosed vessels in carcinomatous ulcer from which severe hemorrhage had occurred. *D* entire duodenum. *N* metastatic node resected from porta hepatis. *M* metastatic nodes excised from along right gastric vessels and celiac axis. Head of pancreas also excised but not seen in photograph.

gional metastases, cholecystojejunostomy was performed with choledochojejunostomy just proximal to this. The common duct was not simply ligated because of the danger of leakage following this step. The transected neck of the pancreas was implanted into the afferent limb of the loop of jejunum brought up for the above mentioned anastomoses. Three large soft rubber drains were placed at the site of excision. The wound healed

without formation of pancreatic or biliary fistulae, and now 10 months later the patient is well and at work in his usual occupation

Large carcinomas of the mid portion or lower portions of the stomach may extend backward actually to invade the body of the pancreas Conversely carcinomas of the body of the pancreas may extend forward to



Fig 18 —Case 98 (35439?) Photograph of surgical specimen consisting of most of S stomach and *Sp* spleen Large carcinoma *C* of stomach infiltrated distal portion of body of pancreas necessitating resection of *P* invaded portion of the latter en masse with most of stomach Patient well and back at work 7 months after operation

invade the stomach and give rise to the clinical picture of gastric cancer Even at laparotomy the neoplasm may appear to be primarily in the stomach and the true site of origin is discovered only on pathologic examination of specimen or at necropsy

Where gastric carcinoma involves only a small portion of the anterior surface of the pancreas the latter invasion is dissected free by incision into the pancreatic parenchyma The fresh surface of the pancreas may then be covered by approximation of the peritoneum or may indeed

be left alone after hemorrhage has been controlled Figure 18 shows a surgical specimen consisting of most of the stomach the spleen and the distal portion of the pancreas invaded by gastric carcinoma (Case 98 D [154392]) The patient *remains well 7 months after operation* Where there is considerable involvement of the body of the pancreas by gastric



Fig 19 —Case 56 (283382) Photograph of posterior aspect of surgical specimen consisting of *St* entire stomach *P* pylorus with *C* carcinoma of lesser curvature infiltrating backward onto *B* body of pancreas The latter has been dissected free from close adherence to stomach *T* tail of pancreas *Sp* spleen *E* esophageal orifice

carcinoma excision necessitates removal of the body of the pancreas and stomach en masse (Figs 19 Case 56 [283382] and 20 Case 59 [273781])

High girdle distribution of pain in the presence of clinical and roentgenologic evidence of gastric cancer suggests secondary involvement of the pancreas as in the following patient

Case 17 —F R (290609) male 40 years of age Admitted October 22 1942 because of difficulty in swallowing and regurgitation of food during the previous 3 months epigastric pain with high girdle distribution of 7 months duration and loss of 70 pounds in weight



Fig. 20.—Case 59 (273781). Surgical specimen consisting of most of cancerous stomach, spleen and *P–P*, body and tail of pancreas. The latter is beneath omentum, but transected neck of pancreas is seen at *N*. *E*, level of transection of stomach, a few centimeters below cardioesophageal orifice. The body and tail of pancreas were also resected because of carcinomatous infiltration into the stomach.

during the previous year. Barium fluoroscopy revealed a large polypoid lesion in the upper portion of the stomach and rigidity of the gastric walls in this region. The clinical diagnosis was carcinoma of the stomach, and laparotomy was performed on November [illegible] 19[illegible] as follows.

PANCREATO-SPLENO-TOTAL GASTRECTOMY (FIG. [illegible])

1. A high mid line incision was made. Palpation revealed carcinoma of the stomach involving the lesser curvature to the esophagus and extending over most of the posterior gastric wall. The latter was rather intimately adherent to the anterior aspect of the body and the tail-end of the pancreas. There were no hepatic metastases visible, but along the lesser and greater curvatures there were numerous enlarged and firm lymph nodes. To encompass the lesion it was necessary to perform a total gastrectomy, with resection of the body of the pancreas and spleen.

2. The greater curvature was freed by transection of the gastrocolic omentum to include all enlarged nodes in its upper portion, with ligation of right and left gastric arteries and veins.

3. Transection of the pylorus was performed, with invagination of the duodenal stump and retraction of the lower stomach cephalad.

4. Transection of the neck of the pancreas at the level of the superior mesenteric vein and ligation of the proximal stump of the neck were carried out.

5. Double ligation and transection of the splenic artery and vein at the level of the transected neck of the pancreas were made.

6. The stomach, the body of the pancreas, and the spleen were then retracted cephalad over the left costal arch, and the first long loop of jejunum was brought upward through a hiatus in the transverse mesocolon. The left lobe of the liver was retracted mesially after severance of the left hepatodiaphragmatic ligament. Interrupted silk sutures were placed between the serosa of the apex of the jejunal loop and the posterior aspect of the abdominal esophagus near its junction with the stomach.

7. The esophagus was transected just above the clamped cardia, and the specimen was removed.

8. The esophagojejunostomy was completed, using two layers of interrupted sutures, silk for the seromuscular coat and chromic O catgut on an atraumatic needle for the inner row. Interrupted silk sutures were inserted between the jejunum and the undersurface of the diaphragm on each side of the anastomosis. The left lobe of the liver was permitted to fall back into its normal position.



Fig. 21.—Case 17 (90,659). Surgical specimen consisting of *St* entire stomach, *P* body and tail of pancreas and *Sp* spleen resected en masse for carcinoma of upper half of stomach extending backward to adhere to anterior aspect of body of pancreas. *E* esophagus, *P* pyloric sphincter. Patient unable to eat prior to operation; after operation could ingest small meals. Lived 10 months with brief period of gain in weight and about 3 months of quite comfortable existence, ambulatory most of the time.

9 Jejunojejunostomy was performed between the afferent and the efferent loops of the jejunum below the level of their passage through the hiatus in the transverse mesocolon Attachment of the mesocolon to the jejunal loops as they pass through the hiatus was made by interrupted silk sutures

10 The abdominal wound was closed with a large soft rubber drain to the site of the spleen and the body of the pancreas

The surgical specimen (Fig 18) consisted of the entire stomach and the adherent body and tail of the pancreas the latter of which measured 11 × 3 × 1 5 cm and the spleen which measured 11 × 6 × 3 cm Although most of the gastric wall was thickened there was an ulcerating and fungating lesion 6 cm in diameter near the cardia involving the lesser curvature anterior and posterior surfaces There were two separate and smaller rounded masses on each side of the cardiac orifice although the latter was patent The weight of the whole specimen was 430 gm Histologic study revealed anaplastic medullary carcinoma of the stomach with metastases to numerous lymph nodes

Convalescence was uneventful for the 25 days following operation However on the twenty fifth day and for the next 4 days the temperature gradually rose to 102 5° F A large hemostat was inserted into the sinus formed by the soft rubber drain and was pushed upward under the left lobe of the liver where a large pocket of pus was broken into and drained Recovery was prompt and the patient was discharged on the fifty sixth day after the initial operation

Following his return home he was moderately active and took small feedings hourly He was able to gain a few pounds in weight He remained fairly comfortable for a few weeks but was again admitted to the hospital on March 29 1943 4 months and 3 weeks after the first operation He had become markedly cachectic and icteric was very weak and now weighed approximately 62 pounds He complained of severe abdominal pain and examination of the abdomen revealed a generalized muscular rigidity through which however many scattered deeply situated irregular masses could be palpated He died 19 days after admission and 5 months and 1 week after the operation Necropsy revealed extensive abdominal carcinomatosis

In the following patient pancreato spleno total gastrectomy was also performed but with less extensive resection of the body of the pancreas

Case 35 —F S (354873) *white female 61* years of age Admitted January 6 1944 complaining of a sensation of abdominal distention after meals and 45 *pounds loss in* weight for the previous 6 months dull epigastric pain for 3 months becoming *quite severe* at times and a mid-*epigastric mass that she could* palpate in the previous 2 months Physical examination revealed this mass to be about 6 cm in diameter just above the umbilicus firm and movable upon deep inspiration There were no other findings except marked emaciation Barium fluoroscopy of the stomach was interpreted to show *carcinoma of the mid* portion of the stomach

Operation was performed January 16 1944 as follows

1 High mid line incision

2 Palpation of the stomach revealed dense carcinomatous infiltration of most of the organ with enlarged lymph nodes along the greater and lesser curvatures The pylorus and the cardiac regions were free from macroscopic evidence of the tumor There was adhesion of the mid posterior wall of the stomach to the distal portion of the body of the pancreas This appeared to be fibrous in character and not due to neoplastic infiltration There were no apparent liver metastases

3 Transection of the pylorus was carried out after division of the right gastric vessels near the lesser curvature and division of the gastrohepatic omentum When the stomach was elevated cephalad the fibrous adhesions to the pancreas were divided by sharp dissection The gastrosplenic vessels were divided and ligated and the omentum was transected near the attachments to the transverse colon

4 When the stomach had been completely mobilized after division of *the left gastric vessels except for the esophageal attachment* no gross evidence of carcinomatous spread in the periaortic lymph nodes was visible although there was direct spread into the retroperitoneal areolar tissues For this reason it was decided to resect the distal half of the body of the pancreas and spleen since the former had been closely adherent to the cancerous stomach The body of the pancreas was transected at its mid point The proximal stump was closed by interlocking mattress sutures The distal half of the gland together with the spleen was removed after ligation of the splenic vessels *at the level of the pancreatic transection*

5 Esophagojejunostomy according to the Roscoe Graham technique (see chap X) was then performed with enteroenterostomy below the hiatus in the transverse mesocolon

6 Closure of the abdomen was made with three soft rubber drains—*one to the stump of the pancreas and two to the site of the spleen*

The surgical specimen (Fig 22) consisted of the entire stomach the

spleen and the distal portion of the body and tail of the pancreas—the latter tissue weighed 38 gm All the mid portion of the stomach was involved by carcinoma there being only 3 cm of the wall at the pyloric portion free from gross evidence of tumor On the lesser curvature the growth extended almost to the cardia The stomach wall was thickened in the involved portions and an actual ulceration 6×5×5 cm was present on the anterior wall

Microscopic sections showed adenocarcinoma Sections from six nodes all showed metastases The pancreas itself was not invaded by carcinoma

Convalescence was complicated by a moderately severe wound infection and cystitis The patient was also not co operative in taking food by mouth and nutrition had to be carried out entirely parenterally at intervals by injections of casein digests gelatin and glucose for periods varying from 7 to 14 days She was discharged from the hospital March 29 1944 able to be up for several hours a day However she succumbed 3½ months after operation presumably of metastases

Extension of gastric carcinoma into the transverse mesocolon and regional nodes may occur without involvement of the body of the pancreas i e spread appears to occur forward and downward rather than backward and upward In Case 94 (320763) a forty-eight year old male laparotomy revealed what appeared to be extension of gastric carcinoma as described above Radical gastrectomy was performed together with resection of the invaded transverse mesocolon and involved nodes including those about the superior mesenteric vessels The middle colic artery was spared and thus partial colectomy was avoided Study of the surgical specimen (Fig 23) revealed *three* separate neoplasms in the stomach—a scirrhous carcinoma just proximal to the pylorus a benign papilloma just proximal to this and an ulcerating carcinoma proximal to the latter Histologic study confirmed extensive metastases in the nodes resected The patient was well for 8 months after operation but died of recurrences 6 months later

Carcinoma of the stomach in addition to direct spread to the body of the pancreas may at the same time have extended downward and forward to involve the transverse mesocolon and might thus surround the middle colic artery and its branches In addition there may be extension into the transverse colon itself

In this situation it becomes necessary to remove the involved portion of the stomach the body of the pancreas and the transverse colon en masse



Fig 22.—Case 33 (521879) Surgical specimen (spread out) consisting of entire stomach, spleen and distal portion of body and tail of pancreas (P, P) (white arrow indicates esophageal orifice) resected for large carcinoma (C) in upper portion of stomach that had extended backward onto superior posterior abdominal wall. There were dense adhesions to distal portion of body and tail of pancreas but no gross invasion by tumor.



A

Fig 23 —Case 94 (3.0763) A external view of surgical specimen consisting of lower three fourths of stomach bearing malignant tumors and O resected transverse mesocolon N nodes removed from about superior mesenteric vessels



B

B as above stomach opened showing three neoplasms C scirrhous carcinoma in pylorus P benign papilloma U ulcerating carcinoma Patient well and returned to usual occupation 8 months after operation

Resection of the spleen, together with these structures, facilitates the procedure when much of the stomach is to be removed

Two patients in whom such operations were performed are described below

Case 16 —Whit (257337) male 56 years old Admitted to the hospital on October 5 1941 complaining of epigastric pain for 1 year not related to eating The pain had become more or less constant in the previous 2 months and had awakened him from sleep on several occasions There had been periods of nausea and vomiting but this was not a complaint at this time There had been loss of weight (exact amount not known) and strength during the previous year Physical examination was negative except for evident emaciation The patient was not acutely ill Roentgenograms of the stomach suggested carcinomatous infiltration of the walls but a large polypoid or ulcerating lesion was not observed Gastroscopic examination revealed an infiltrating carcinoma of the upper posterior wall of the stomach Gastric analysis after histamine revealed 56 clinical units of free acid

Laparotomy was performed October 16 1941 as follows

PANCREATO SPLENO-TRANSVERSE COLECTO-TOTAL GASTRECTOMY (FIG 24)

1 An L-shaped incision was made the vertical component in mid line and the horizontal component extended approximately 8–10 cm to the left below the level of the umbilicus A large carcinomatous mass arising from the entire posterior aspect of the stomach was encountered, there was direct extension backward onto the body of the pancreas and direct extension forward into the mid portion of the transverse mesocolon with infiltration about the mid colic artery and invasion of the colon wall itself over a segment approximately 8 cm in length No hepatic metastases were visible or palpable

2 Transection of the pylorus was performed with invagination of the duodenal stump after ligation of the right gastric artery and vein near the lesser curvature

3 The next step was the isolation of the transverse colon The hepatic flexure was retracted downward and to the left This brought tension upon the hepatocolic ligament and lateral reflection of the peritoneum of the ascending colon These reflections were incised and permitted of considerable mobilization of the cecum the ascending colon and the hepatic flexure

The splenic flexure was then retracted medially, and the lienodiaphragmatic and lienocolic ligaments and the lateral leaf of the mesentery of the descending colon and sigmoid were incised This permitted of considerable mobilization of these segments of colon

The transverse colon was transected just distal to the hepatic flexure and just proximal to the splenic flexure Two crushing clamps were applied at the level of each transection These were removed and linen ligatures were tied tightly in the grooves made by the clamps Purse string sutures were then placed in the colon wall 3–4 cm away from the ligations on each side The colon was divided between the ligatures and each stump was immediately inverted and the purse string sutures tied

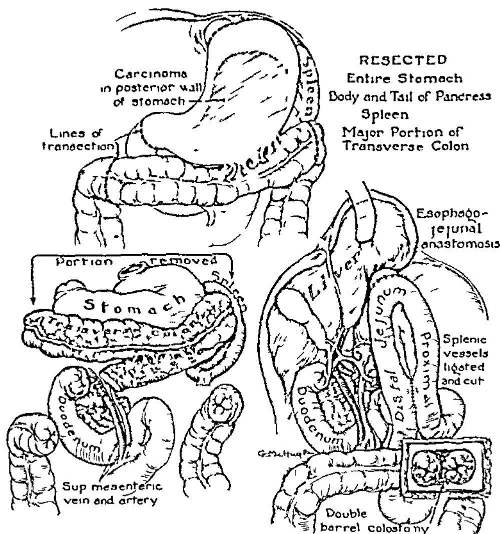


Fig 24 —Case 16 (257337) Schematic representation of total gastrectomy transverse colectomy splenectomy and removal of body and tail of pancreas for carcinoma primary in stomach with extensions to neighboring viscera Esophagojejunostomy jejunojejunostomy and colostomy Latter not subsequently closed Patient lived for 6 months and gained weight for a time Death due to carcinomatosis

tightly There were, thus two purse-string invaginations at each level of transection The mesentery of the transverse colon was then incised along its origin, and the middle colic artery and vein were secured and ligated close to their origin at the superior mesenteric artery

4 The stomach and the transverse colon (with the *omentum*) were elevated cephalad and the spleen was grasped in the right hand and used as a handle to elevate the distal *portion of the body and tail of the pan creas* The neck of the pancreas was divided at the level of the superior *mesenteric artery and the proximal and distal stumps were ligated The* splenic artery and vein at this level were divided and ligated

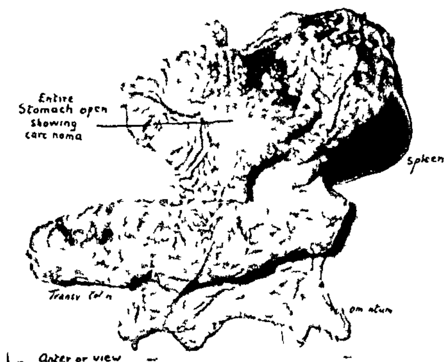
5 *The left gastric vessels were secured doubly ligated and divided be* fore they reached the lesser curvature of the stomach The left hepato *diaphragmatic ligament was divided and the left lobe of the liver was re* tracted mesially The stomach and accompanying viscera were retracted cephalad over the left costal arch The first *long* loop of jejunum was brought up to the posterior aspect of the abdominal esophagus and at tached to it by interrupted silk sutures *The* esophagus immediately *above* the stomach was divided (clamp on cardia), and a specimen was removed

6 *The* remainder of the procedure was similar to that of a total gas trectomy as previously described An enteroenterostomy was performed between the afferent and the efferent loops of the jejunum about 10 cm below the esophageal jejunal anastomosis

7 The mobilized ascending and descending colons were brought to gether and out through a stab wound to the left of the mid line incision as a closed double barrel colostomy

8 Closure of the abdominal wound was carried out with three large soft rubber drains to the site of the spleen and the body of the pancreas

The surgical specimen (Fig 26) consisted of the entire stomach the body and tail of the pancreas the spleen and the transverse colon with practically all the omentum attached The stomach exhibited an hour glass constriction in the center due to infiltrating carcinoma In the most constricted portion there was a shallow ulceration about 5 × 4 cm The mid portion of the body of the pancreas was attached to the central por tion of the posterior wall of the stomach obviously because of infiltration by neoplasm into the former There was also direct extension of carcinoma *from* the mid portion of the greater curvature into the transverse meso colon and infiltration of the wall of the transverse colon itself in its central



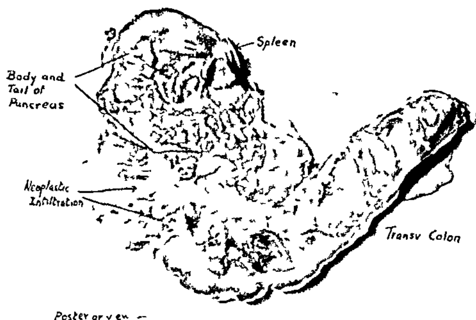


FIG 25 —Case 16 (257337) Surgical specimen obtained from operation depicted in Figure 24 and consisting of entire stomach body and tail of pancreas spleen and transverse colon resected en masse Patient lived 6 months received palliation and gained several pounds in weight

portion The segment of the excised transverse colon measured 37 cm in length and consisted of practically all this portion of the colon

Histologic study revealed the primary growth to be an adenocarcinoma with moderate fibrous tissue proliferation about the invading malignant cells Sections from the adherent colon revealed invasion of the wall by neoplastic acini—these extended into the mucosa itself Sections from eight lymph nodes taken at random from near the stomach and in the greater omentum showed metastatic carcinoma in three

The postoperative course was complicated by a wound infection and left subdiaphragmatic abscess but the patient's general condition remained satisfactory He was discharged 6 weeks after operation with colostomy functioning normally By the sixth week after discharge he had gained about 7 pounds weight and was enjoying several small feedings a day Moderate physical activity was possible The epigastric distress present before operation had been relieved Death occurred at home 6 months after operation Necropsy was not obtained but the final picture suggested rapidly developing carcinomatosis There was profound asthenia but no pain prior to death

The other patient was operated upon in a similar manner for a large carcinoma of the stomach that had spread into the body of the pancreas and the mid portion of the transverse colon but he died on the nineteenth postoperative day of peritonitis (Case 46 R zg [274120]) Necropsy revealed the source of this infection to be the esophagojejunostomy although gross leakage at this anastomosis could not be demonstrated The patient was permitted 75 cc of lemonade by mouth on three occasions 72 hours before evidence of peritonitis developed and this might have initiated the process by microscopic leakage The first patient referred to above, received nothing by mouth for 25 days and casein digest (Amigen) and glucose by vein daily The latter patient also received casein digest and glucose by vein for 18 days following operation and nothing by mouth during this period except as noted above

The following is an example of the extensive spread of a malignant gastric neoplasm to neighboring viscera and tissues subjected to operation It is believed that this is the most radical operation yet recorded (with recovery)

Case 40—I B (339809) white male 28 years of age Admitted August 9 1944 complaining of sensation of emptiness in epigastrium which had begun in November 1943 changing later to a gnawing pain coming on 2 hours after meals This pain could be con

trolled by frequent small feedings By April 1944 he appreciated a palpable mass in the left upper quadrant Generalized weakness became more pronounced there was a loss of 40 pounds in weight during the previous several months and at the time of admission he was unable to ingest more than an occasional mouthful of food since his stomach would not hold more Such attempts at eating also induced aggravation of severe upper abdominal pain which was now constantly present

Physical examination revealed an emaciated subject with large smooth mass filling the left upper quadrant of the abdomen and producing a forward bulge in this region The mass was not ballotable and did not move with respiration

Roentgenographic study revealed almost the entire stomach to be involved by the tumor The latter produced extensive constriction in the lumen of the upper third

Laparotomy was performed August 17 1944

TOTAL GASTRECTOMY PARTIAL HEPATECTOMY SPLENECTOMY RESECTION OF BODY AND TAIL OF PANCREAS UPPER RETROPERITONEAL TISSUES TRANSVERSE COLON PRACTICALLY THE ENTIRE OMENTUM AND THE ABDOMINAL PARIETES IN THE LEFT UPPER QUADRANT EXCEPT FOR SKIN AND UNDERLYING FASCIA (FIG 20)

1 A high mid line incision was made extending 8 cm below the umbilicus Manual exploration of the left upper abdomen was not possible because of actual infiltration of the deeper portions of the abdominal wall by tumor which appeared to fill the left upper quadrant Palpation of the right lobe of the liver revealed no evidences of metastases The peritoneal surfaces of the small bowel were smooth and glistening

2 The skin and superficial fascia of the left margin of the wound were grasped by several towel clips and the musculature was split in such a way that the deeper portions adherent to and infiltrated by tumor were cut from the more superficial portions An area about 8 × 10 cm was freed in this manner The wall in the left upper quadrant was thus left composed of skin and superficial fascia

3 It now became possible to ascertain that there was an enormous tumor involving practically the entire stomach and infiltrating into the left lobe of the liver The mass was immobile because of apparent infiltration into the upper posterior retroperitoneal tissues

4 The base of the left lobe of the liver was grasped by the left hand fingers above and thumb on undersurface and firm compression was exerted while the liver was incised wide of the infiltration into its most protruding portion permitting the involved liver segment to fall away adherent to the tumor mass The fresh surface of the liver was sewed over with a continuous mattress suture the left hand was then removed and the suture was tied sufficiently tight to afford hemostasis

5 The massive tumor still could not be mobilized The pylorus was transected and the duodenal stump was inverted

6 When the gastric stump was elevated it became apparent that most of the posterior wall of the stomach was "frozen" in place Manipulations of the stomach resulted in a large tear through the anterior wall of the upper portion which had been completely replaced by tumor Gastric con

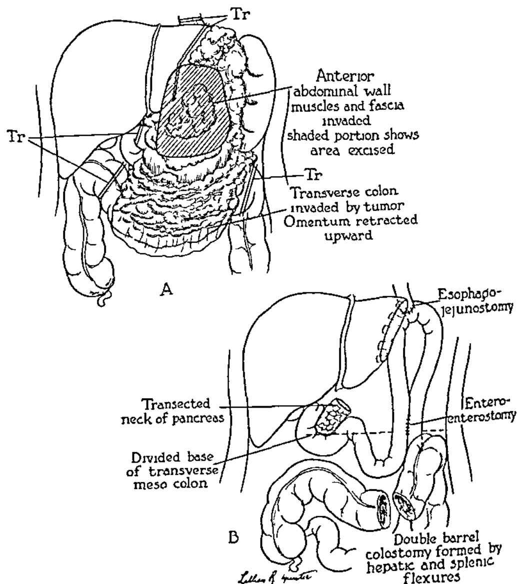


FIG 26 —Case 40 (339809) A massive sarcoma involving all of stomach invading left lobe of liver transverse mesocolon transverse colon body and tail of pancreas retroperitoneal tissues in upper abdomen and musculature of left upper quadrant *B* after resection of entire stomach half of left lobe of liver body and tail of pancreas upper retroperitoneal tissues transverse colon entire omentum musculature and fascia of left upper quadrant of abdominal wall (skin and subcutaneous tissue remained to form wall in this region) Patient survived operation to receive palliation (see text)

tents were rapidly aspirated and sponged away With great difficulty a rubber covered clamp was placed across the upper portion of the stomach, and the esophagus was transected above its junction with the stomach

7 The spleen was grasped by the right hand and pulled downward after division of the lienodiaphragmatic ligaments This brought the upper portion of the tumor mass and the stomach downward The tumor was liberated from the posterior abdominal wall by scissors dissection The body and tail of the pancreas infiltrated by tumor came away with the mass The neck of the pancreas was transected and the splenic vessels ligated and divided

8 The upper portions of the tumor and the invaded tissues were now free The neoplasm was then observed to have infiltrated into the transverse mesocolon and into the wall of the transverse colon itself Almost all the transverse mesocolon and transverse colon were involved It was also noted at this point that the mesentery of the first loop of the jejunum presented diffuse neoplastic infiltration This was not directly continuous with the mass of the tumor in the transverse mesocolon and was interpreted as being a metastatic process Excision of the latter did not appear feasible in view of its situation about the main trunks of the superior mesenteric vessels

9 Dissection to free the posterior inferior portions of the mass was continued in the retroperitoneal spaces below the level previously occupied by the body of the pancreas The middle colic vessels were ligated and divided near their junction with the superior mesenteric artery and vein The base of the transverse mesocolon was elevated over its entire length The tumor mass and adherent structures were then wrapped in towels brought out of the wound and laid over the lower anterior abdominal wall their only connections with the interior of the abdomen being by the *right and left extremities of the transverse colon*

10 The first long loop of the jejunum beyond the first segment whose mesentery was infiltrated by tumor was brought upward to the stump of the esophagus and anastomosed to it end to side with two rows of interrupted silk sutures sutures were also placed between the jejunal serosa and the undersurface of the diaphragm about the anastomosis Enteroenterostomy was performed between the afferent and the efferent loops of the jejunum to the above anastomosis

11 The hepatic and splenic flexures of the colon were mobilized permitting their approximation in the lower angle of the mid line incision and several interrupted sutures were inserted between these loops

12 The mid portion of the abdominal wound was closed A Mikulicz type of tampon drain was inserted through the upper angle into the left upper abdomen, several soft rubber drains were also inserted

The large tumor mass was elevated from the sheets and Payr clamps were applied to afferent and efferent loops of the colon above the level of the skin (obstructive resection) and the large mass was cut away



FIG 27 — Case 40 (339809) Surgical specimen all tissues and organs resected en masse for S massive sarcoma of stomach consisting of *St* entire stomach *E* esophagus *P* pyloric sphincter *Sp* spleen *O* entire omentum *T* transverse colon *L* portion of left lobe of liver *M* metastatic mass from above head of pancreas *W* musculature deep fascial layers and parietal peritoneum from left upper quadrant of anterior abdominal wall Upper posterior retroperitoneal tissues and body and tail of pancreas were adherent to posterior aspect of specimen and are not seen in photograph Specimen weighed 2 400 gm Operation terminated by esophagojejunostomy and double-barreled colostomy (hepatic flexure and splenic flexure brought together in lower angle of mid line abdominal incision)

The surgical specimen weighed 2 400 gm (Fig 27) As indicated above it consisted of the entire stomach most of which had been replaced by dense, coarsely lobulated tumor tissue Attached to the upper portion of the tumor there was a segment of the left lobe of the liver measuring 15×6×4 cm which was actually invaded by neoplastic tissue The posterior aspect (Fig 28) of the specimen presented retroperitoneal tissues invaded by the tumor the body and tail of the pancreas and the areolar

tissue from the base of the transverse mesocolon The spleen not actually invaded by the tumor was enlarged because of the constriction of the splenic vein The segment of musculature and fascia of the anterior abdominal wall attached to the anterior aspect of the tumor mass measured 12×9 cm and was 4 cm in thickness Along the inferior portion of the specimen is the transverse colon with practically the entire omentum

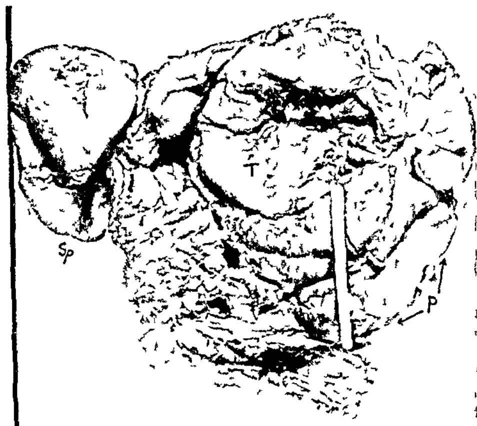


FIG 28 —Case 40 (339809) Photograph of surgical specimen formalin hardened shown in Figure 27 posterior view *T* the massive tumor replacing most of stomach is exposed *P* body and tail of pancreas *Sp* spleen Resected portion of left lobe of liver not shown in this view

contrasted upward about it The mid portion of the transverse colon was extensively infiltrated by the tumor which extended beneath the mucosa in the one portion There were abscess cavities within the mass of neoplastic infiltration in the anterior abdominal wall and within the portion of neoplasm that had replaced the fundic segment of the stomach Sections showed large round cell sarcoma (lymphosarcoma?)

The postoperative course was remarkably smooth The patient himself made few complaints On the second day the tampon drain was removed

from the left upper abdomen and a Pezzar catheter was inserted as far as possible, aspiration by syringe was carried out at 2 hour intervals with the return of 30–60 cc of pus on each occasion This tube was changed every day At the end of a month the tube was not reinserted X ray therapy was given to the abdomen after the third week

Feedings were withheld until the tenth day, when 30 cc of water an hour for 12 hours was permitted This was gradually increased until by the end of the third week, the patient was consuming the equivalent of

TABLE 8

CASE 40 F BOIK (339809)

RESECTION OF ENTIRE STOMACH SPLEEN HALF OF LEFT LOBE OF LIVER BODY AND TAIL OF PANCREAS AND TRANSVERSE COLON ESOPHAGOJEJUNOSTOMY

(Nutritional Data 8 Day Period Taken as Example Showing Advantage of Intravenous Protein Nutrition as Supplement to Oral Feeding)

Day	Nutritional Intake: Intravenous Gelatin Nitrogen (Gm)	Nutritional Intake: P O Nitrogen (Gm)	Nutritional Intake: P O Carbohydrate (Gm)	Nutritional Intake: P O Fat (Gm)	Nitrogen Excretion (Urine): Calories (P O)	Nitrogen Excretion (Urine): Total Nitrogen (Gm)	Nitrogen Excretion (Urine): Gelatin Nitrogen (Gm)	Nitrogen Excretion (Urine): Urea Nitrogen (Gm)	Nitrogen Balance	Blood
8 29 44	10	4	110	80	1 344	12 4	4 7	10 0	+ 5 20	Hematocrit 31 R B C 3 0? M plasma protein 5 18 A/G=2 17 3 01=0 72
8 30	9 8	5 6	107	6	1 126	16 7	7 75	14 8	− 1 30	
8 31	10 0	6	1 6	3	1 323	10 00	3 5	7 2	+ 6 70	
9/1	10 0	8 5	146	84	1 548	8 00	2 54	6 0	+10 50	
9 2	10 1	8 5	146	84	1 548	21 10	8 4	18 4	− 2 50	
9 3	10 0	8 5	146	84	1 548	18 2	8 8	16 0	+ 0 30	
9/4	9 5	9 4	170	10?	1 834	9 7	5 5	7 2	+ 9 40	
9/5	9 90	13 9	30?	104	528	14 3	5 5	9 9	+ 9 50	Hematocrit 29? R B C 3 01 M plasma protein 5 51 A/G=2 ? 3=0 9?

NOTES

Assuming 15 per cent of U[illegible] n[illegible] nitrogen excretion was [illegible] total nitrogen [illegible] for the 8-day period = 32 1 gm = 200 625 gm protein (dry weight)

Total nitrogen injected as gelatin = 79 5 gm nitrogen excreted in urine as gelatin = 40 71

Injected gelatin present in blood at end = 206 5 gm

Protein given as food per os = 4 8 125 gm

The injection of gelatin [illegible] almost 50 per cent increase in protein made available to the patient During the period the resulting plasma protein increase 0 33 gm per cent

1 500–2 000 calories of "soft diet" a day in hourly feedings from 8 00 A M to 8 00 P M Inasmuch as the patient had lost considerable weight and was poorly nourished before the operation intravenous casein digests and glucose were given prior to and following operation Later when he was eating by mouth and in order to "force" nutrition protein nutriment was also given in the form of intravenous casein digests and gelatin To study the utilization of the gelatin (8 per cent in saline) casein digest was not given for a period The data for 8 days (patient on a nitrogen balance regime) are given in *Table 8* Because of the colostomy, which functioned frequently the fecal nitrogen was not determined The data in Table 8

illustrate the advantages of parenteral protein injections (in this case, gelatin) in increasing the protein available to a patient when nutritional support is of paramount importance The protein utilized was increased by almost 50 per cent of that taken by mouth

As previously stated it is believed that the above operation is the most extensive resection on record for neoplastic disease The objective accomplished was that this young patient was again permitted to eat by mouth and he enjoyed his food He was relieved from abdominal pain His existence was quite comfortable for several weeks During a brief period there was regurgitation of bile at frequent intervals but this soon subsided Roentgenographic studies revealed a diverticulum from the jejunum near the esophagojejunal anastomosis as the probable cause of this disturbance X ray therapy to the abdomen was attempted but not well tolerated Three weeks after operation multiple subcutaneous metastases appeared at various locations about the body At times his appetite was excellent By October 4 1944 his condition ceased to improve His appetite decreased and he died suddenly October 9 1944 Necropsy revealed recurrences in the left upper abdomen There was no metastases in the liver or in the lungs

The operation took 4 hours and this afforded true palliation for almost 8 weeks The patient is cited as an example of how extensive a surgical operation may be carried out with recovery

Extending total gastrectomy to include the body and tail of the pancreas the upper abdominal retroperitoneal tissues and the transverse colon is obviously a much more formidable procedure than simple total gastrectomy That such procedures can be carried out successfully is demonstrated by the patients described above The results may be summarized as follows

Total gastrectomy splenectomy and resection of body of pancreas	3 patients	1 operative death 1 survival 3 months 1 survival 5 months
Total gastrectomy splenectomy resection of body of pancreas and transverse colon	2 patients	1 operative death 1 survival for 6 months
Total gastrectomy splenectomy resection of body of pancreas transverse colon portion of left lobe of liver fascia and musculature of left upper quadrant of abdominal wall and upper retroperitoneal tissues	1 patient	1 survival for 3 months
Subtotal gastrectomy splenectomy and total pancreatectomy (see chap xii)	1 patient	1 survival for 3 months

Of the 7 patients operated upon there were 2 operative deaths—an immediate mortality of 28 8 per cent When malignant neoplastic disease has spread to such an extent as to require the procedures described prolonged survival cannot be anticipated All the patients operated upon did not ingest much food prior to operation as this induced severe pain and/or vomiting Those that survived—72 per cent of the small series—did receive palliation in that they were afforded periods of being able to eat without pain and they became at least partially ambulatory If survival for appreciable periods did not obtain in these patients the fact demonstrated is the magnitude of surgical procedure that is possible and the question is raised as to whether wider resections (without transverse colectomy), applied in situations now generally treated by simple total gastrectomy might not ameliorate the results of the latter operation Wide resection through apparently uninvolved normal tissue is a fundamental principle of cancer surgery

CHAPTER VII

OPERATIONS IN THE PRESENCE OF PERFORATED GASTRIC CARCINOMA

PERFORATION of gastric carcinoma resulting in fatal peritonitis is very rare when the neoplasms are of small size In the more advanced stages especially if operation has not been previously performed perforation may often be the terminal accident Perforation may be the result of liquefaction necrosis of the central portions of the neoplasm on the other hand since about 25 per cent of cancerous stomachs secrete acid gastric juice the digestive action of the latter may be an important factor in addition to spontaneous necrosis

In 1934 Aird reviewed 79 cases of perforated carcinoma of the stomach reported in the literature Bisgard and Overmiller collected 138 cases published between 1934 and 1944 No one surgeon has operated upon more than a few of such patients

The clinical pictures associated with perforated gastric carcinoma are quite definitely of two types In one which comprises about two thirds of the cases there are no really acute phenomena The patients already debilitated because of the disease appear to continue on a rapidly downhill course and expire necropsy revealing the perforation and general peritonitis In some instances abdominal pain and distention may be present a short time before death but these are not of acute onset or apparently very severe In the other type which comprises about a third of the cases the clinical manifestation is an acute episode quite similar to perforated peptic ulcer and indistinguishable from it unless of course the patient is known to have gastric carcinoma when the true nature of the situation is appreciated

The writer has operated upon two patients with perforated gastric cancer each an example of the types previously described In the following patient in whom the perforation was silent it was not suspected prior to operation This patient also affords an example of the fact that gastric carcinoma may perforate slowly giving rise to chronic abscess formation the walls of which prevent escape of gastric contents into the peritoneal cavity thus obviating general peritonitis

Case 57—Cont (303086) *Very emaciated white male 6? years of age* Admitted on February 21 1943 having had postprandial pain for 2 years relieved by food or alkali At the onset an ulcer was demonstrated roentgenologically in another institution In the preceding few weeks tarry stools and occasional *nausea and vomiting of* coffee ground material had occurred There was now marked anorexia No acute episodes of abdominal *pain occurred* An abdominal mass was palpable measuring about 8 cm in diameter in the upper right quadrant seemingly continuous with the liver The patient was very weak and it was decided not to carry out further roentgenographic studies Laparotomy was performed on *February 27 1943 as follows*

TOTAL GASTRECTOMY WITH RESECTION OF BODY OF PANCREAS AND SPLENECTOMY, *DRAINAGE OF SUBHEPATIC ABCESS FROM PERFORATED* CARCINOMA OF THE STOMACH EXCISION OF THE ABSCESS

1 The abdomen was entered through a high mid line incision and an abscess was encountered in the space between the undersurface of the left lobe of the liver and the lesser curvature of the stomach This was well *walled off by omentum and fibrous adhesions which formed a rather dense* abscess wall It was evidently of relatively long standing The purulent contents were evacuated, care being exercised to avoid contamination below the transverse colon The cavity communicated with the interior of the stomach through a perforation about 3 mm in diameter *in the center of a large carcinoma involving the lower two thirds of the stomach* Metastatic nodes were palpable and visible along the lesser curvature to the esophagus The stomach itself was immobilized by infiltration of the growth onto the anterior surface of the body of the pancreas No *metastases* were visible in the liver *except for one nodule in* the left lobe about the size of a pea

Inasmuch as the whole upper abdomen had been soiled by the opening of the abscess and as the large gastric carcinoma was obviously necrotic *about the site of the perforation* repair of the latter *did not seem feasible It was decided to perform a total gastrectomy* with the abscess wall attached to the stomach and resection en masse of the body of the pancreas and the spleen with the stomach

2 The pylorus was divided and the lower end invaginated *The gastrohepatic omentum was divided near the liver,* several large nodes being found in it

3 With stomach abscess walls retracted upward the neck *of the* pancreas and the splenic artery and vein at the level *of the neck* were ligated and divided *The lienodiaphragmatic* and lienocolic ligaments were divided and the greater curvature of the stomach was freed with the

spleen Using the spleen as a handle the stomach and the body of the pancreas were elevated cephalad and the thick walls of the abscess cavity were mobilized upward with the stomach and the metastatic nodes in the gastrohepatic omentum

4 The first long loop of the jejunum was brought upward and attached to the posterior aspect of the abdominal esophagus by interrupted silk sutures after mobilization and retraction of the left lobe of the liver to the right

5 Transection of the esophagogastric junction was performed and the specimen was removed The esophagojejunal anastomosis was completed and suture of the jejunum was made to the undersurface of the diaphragm no each side of the anastomosis Enteroentero tomy was performed between the afferent and the efferent loops of the jejunum below the level of the transverse mesocolon

6 The abdominal wound was closed with soft rubber drains to the undersurface of the liver and to the sites of the spleen and the body of the pancreas

Study of the surgical specimen (Fig 29) consisting of the structures described above revealed the carcinoma to measure 10 cm in diameter The perforation near the lesser curvature was in the center of the lesion much of which was necrotic The largest of the firm nodes along the greater and lesser curvatures measured 5×3×3 cm The superficial surface of the body of the pancreas was invaded by the carcinoma Histologic sections revealed adenocarcinoma

The immediate postoperative condition was satisfactory On the morning of the fifth day the temperature was normal but that evening it rose to 101° F rectally On the fifth sixth and seventh days it was apparent that general peritonitis had developed and although supportive treatment including chemotherapy was instituted the patient died on the eighth day Necropsy revealed general peritonitis and bronchopneumonia Histologic study of the upper retroperitoneal nodes showed residual metastatic carcinoma

The second patient affords an example of acute perforation similar to that of a peptic ulcer As far as could be determined the presence of a gastric neoplasm was not suspected prior to the acute perforation

Case 8 — An (139357) white male 49 years of age There had been epigastric pain burning in character at intervals for 10 years This was relieved by food or alkalis He had received medical treatment for peptic ulcer at irregular intervals from various physicians



Fig 29 — Case 37 (303058) Posterior view of surgical specimen consisting of S entire stomach with carcinoma in lower portion that has perforated to formation of large chronic abscess. Ab Sp spleen and pan body of pancreas a portion of which was involved in the above-mentioned mass. MN large metastatic node from gastrohepatic omentum

Two and a half months previously he had experienced a spontaneous gastric perforation which was closed in the usual manner in another institution. He was discharged on the 10th day and felt well for 1½ months. He then became nauseated at intervals but accepted this without recourse to medical consultation. Four days prior to this admission he arose in the morning, went to stool, passed tarry material, had emesis of considerable red blood and fainted. He was treated at home by a physician who prescribed absolute bed rest and sedatives for 3 days. Upon entrance to the hospital the red blood count was 3,600,000 and Hb 59 per cent. Physical examination was essentially negative. Roentgenographic examination of the stomach was interpreted as showing a large carcinoma in the lower portion.

Laparotomy was performed on July 29, 1935, as follows:

PARTIAL GASTRECTOMY FOR PREVIOUSLY PERFORATED GASTRIC CARCINOMA. RESECTION OF EXTENSIVE LYMPH NODE METASTASES

1. A high mid-line incision was made to enter the upper abdomen.

2. A rounded carcinomatous mass was observed on the mid-portion of the anterior wall of the stomach. Much of the omentum was adherent to it. There were many large firm nodes along the lesser and greater curvatures and in the omentum. No hepatic metastases were observed.

3. The lower three fourths of the stomach was mobilized together with enlarged nodes in the gastrohepatic omentum and most of the greater omentum. Resection of the lower two thirds of the stomach was carried out in routine manner with posterior Polya gastrojejunostomy. Closure was made without drainage.

Study of the surgical specimen revealed the portion of the resected stomach to measure 18 cm. along the greater curvature. On the mid-portion of the anterior wall of the specimen was an oval, raised carcinomatous ulcer 5-6 cm. in diameter. The irregular crater measured 4 cm. in diameter, and in its floor were several vessels with gaping openings. At one point a linen ligature was present partially imbedded in the lesion (Fig. 30). Sections of seven out of eleven lymph nodes showed metastatic carcinoma.

Convalescence was uneventful. The patient was discharged on the eighteenth day after operation. In several weeks he returned to work as an electrical engineer and continued in good health for over 18 months. In April, 1937, he began to complain of nausea and stated that he had difficulty in eating normal meals. He partook of several small feedings during the day. He began to lose weight and noticed increasing weakness. He was last seen April 14, 1937, and then went to another city, where on

August 15, 1937—2 years and 1 month after the above operation—he died necropsy was not obtained

Perforated gastric carcinomas, as stated above are almost always of appreciable size and therefore must be regarded as in the advanced stage If the accident is survived it would appear on theoretical grounds at least to favor dissemination of the growth

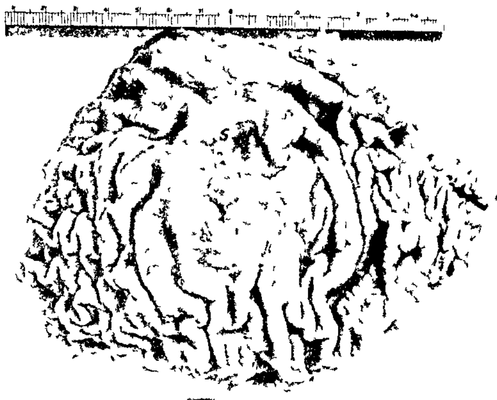


FIG 30 —Case 8 (132357) Surgical specimen consisting of major portion of stomach bearing a large ulcerating carcinoma Two and one half months previously there had been an acute perforation of the latter which had been repaired in another institution Nonabsorbable suture S from previous operation is seen in floor of lesion There were extensive lymph node metastases along both curvatures and in the omentum (not shown in photograph) The patient survived for over 2 years

In Aird's collective review based on 79 cases reported operation was carried out in less than one half of the patients In Bisgard and Overmiller's review there were 115 operations The procedures are shown in Table 9

The immediate mortality in Aird's series was 59 per cent in Bisgard and Overmiller's series it was 68 per cent The statistics showing the best results from primary gastrectomy are not to be interpreted as unquestionably favoring this procedure in all instances The successful cases are

usually reported whereas the failures are not. Primary gastrectomy however should certainly be considered as the procedure of choice but repair and later gastrectomy as in the second instance (Case 8) reported above would also seem to be a logical type of management and possibly affords

TABLE 9

Procedure	Recovered		Died	
	Adams (Up to 1934)	Bisgard (1934–44)	Adams (Up to 1934)	Bisgard (1934–44)
Drainage alone	1	3	4	15
Closure with or without drainage	2	0	6	31
Local excision and closure	1	2	3	4
Closure and gastroenterostomy	5	7	7	16
Closure and jejunostomy	0	0	2	2
Jejunostomy alone	0	0	1	2
Gastrectomy primary	[illegible]	13	0	2

less immediate risks. Deligeniere reported a spectacular case of perforated gastric carcinoma in which repair was carried out and at a subsequent operation resection was performed with survival for 10 years. Against repair and later gastrectomy is the fact that closure of the perforation which is through partially necrotic neoplastic tissue may not be possible because of the lack of "holding power" of such tissue.

CHAPTER VIII

OPERATIONS FOR RECURRENT GASTRIC CANCER

GASTRECTOMY FOR METASTATIC CARCINOMA (TO THE STOMACH)

Recurrence of gastric carcinoma following gastric resection is usually accompanied by such general deterioration in the patient's condition and the recurrences themselves are of such extent that a second operation is ordinarily not envisaged. However, there are exceptions to this rule in that recurrences may be manifested in patients whose general condition is still good. The possibility of reoperation for excision of recurrences should be considered when roentgenograms of the chest are negative for evidence of pulmonary metastases, when there is no left cervical adenopathy (Virchow's nodes), when the liver is not enlarged and nodular, and when there is no evidence of ascites. Palpable masses in the abdomen should not constitute a contraindication to re-exploration.

If the previous operation was a Billroth II resection, obstruction at the gastric outlet would occur from a smaller recurrent mass than would be the case if a Polya type anastomosis had been performed.

The following is an example of attempted palliation of recurrent gastric cancer by secondary operation, although recurrent carcinoma was not the diagnosis made preoperatively.

Case 60.—Lorb (184327), 73 years of age. Subtotal gastrectomy (Polya type) was performed by the author in August 1937 for carcinoma situated high in the cardiac region. Convalescence was uneventful. Because of the small portion of stomach remaining the patient partook of frequent small meals for several months following operation but finally reduced these to three or four regular meals a day. He resumed his usual duties as a police captain a few months after operation and continued in this capacity until the second admission, February 23, 1943. At this time he appeared well but stated he had had a "heavy feeling" in the upper abdomen during the previous 2 months. This discomfort was more or less constant and at times radiated to the back or had a girdle distribution. His general condition was excellent, although diabetes mellitus was present.

Examination of the abdomen revealed a deep, rounded, smooth mass in the right upper quadrant which was interpreted as a distended and tense gall bladder. Cholecystograms were negative.

Because of the constant pain, operation was performed on March 2, 1943, as follows (clinical diagnosis: cholecystitis[?]):

RESECTION OF RECURRENT GASTRIC CARCINOMA, PARTIAL HEPATECTOMY, PARTIAL DUODENECTOMY, TRANSVERSE COLECTOMY, CHOLECYSTECTOMY

1 A high mid line incision was made

2 It became evident that the mass palpated was not distended gall bladder but recurrent carcinoma in the transverse mesocolon at the site of the previous gastric resection The gall bladder was not distended but was adherent to the right lateral aspect of the mass Further inspection revealed that the middle colic artery coursed through the recurrent carcinomatous mass and that in order completely to excise it a segment of transverse colon would also have to be removed The site of anastomosis between the stomach and the jejunum was free from the recurrent carcinoma and was high in the left upper quadrant

The tumor mass was retracted upward and to the left the cystic duct was doubly clamped and divided and the gall bladder was thus mobilized Because there was evidence of infiltration of the gall bladder wall and the adjacent liver by recurrent carcinoma the liver was incised in wedge-shaped fashion about the gall bladder thus permitting it to be completely free except for adhesion to the tumor mass The cut edges of the liver were approximated by interlocking catgut sutures in the liver parenchyma

3 In elevating the tumor mass it became apparent that the invaginated duodenal stump was infiltrated by it This necessitated resection of 3 cm of the duodenal stump and its repair by three concentric purse string sutures

4 The transverse colon was doubly clamped and transected near the hepatic flexure and also near the splenic flexure The transverse mesocolon containing the recurrent tumor mass and corresponding to most of the transverse colon was divided along its origin to permit its removal with the transverse colon The middle colic artery (and vein) was divided near its origin A large portion of the greater omentum was also included in the resected specimen There were metastases in the periaortic lymph nodes but these were not resected

5 End-to-end anastomosis of the colon was carried out with two rows of interrupted sutures after mobilization and approximation of the hepatic and splenic flexures

6 Soft rubber drains were inserted to the right kidney fossa and the abdomen was closed

Study of the surgical specimen (Fig 31) showed it to consist of the re-

current tumor mass about doubled fist size in the transverse mesocolon 22 cm. of transverse colon and its mesocolon, gall bladder, previously invaginated duodenal stump, a wedge-shaped portion of the liver about the gall bladder measuring 7×6×6 cm., and most of the greater omentum. Histologic study of the tumor revealed carcinoma.

Convalescence was at first uneventful, and the diabetes was controlled. However, after frequent severe hiccuping, there was wound disruption on the seventh day postoperative. By the sixteenth day there were duodenal and colic fistulas in the wound. From this time onward the patient's general condition deteriorated rapidly, and he died on the thirtieth day after



Fig. 91.—Case 60 (181327). Surgical specimen from operation for resection of local and regional recurrences 6½ years after subtotal resection of stomach for carcinoma. L, segment of liver with G, gall bladder, the surfaces of which presented metastatic nodules. C, C', and portion of transverse colon. T, large mass of recurrent carcinoma in mesentery of transverse colon. D, duodenal stump with carcinomatous mass.

operation. During the last week of life there was icterus. Necropsy revealed peritonitis and carcinomatosis in the retroperitoneal lymph nodes.

This patient's history is of interest in that it affords an instance of recurrence of gastric cancer manifested 6½ years after subtotal gastrectomy for the primary growth; the liver was still free from metastases.

In the following patient reoperation for recurrent and metastastic carcinoma of the stomach afforded appreciable palliation and prolonged the patient's life, also permitting return to heavy physical work for a period of almost 2 years.

Case C.—Got. (23588), white male, 57 years of age. First admitted to the hospital in April, 1940. A radical gastrectomy (Polya type) was performed by the author for carcinoma April 22, 1940. Recovery and postoperative course were uneventful until December, 1941, when he was readmitted, presenting a distended abdomen and complaining of nausea, vomiting and abdominal pain of several days' duration. An epigastric mass was palpable. Clinical diagnosis: Recurrent carcinoma of the stomach. Because his general physical condition was very good and there was no evidence of metastases beyond the abdomen, operation was performed as follows on December 27, 1941.

HEMICOLECTOMY—PARTIAL JEJUNECTOMY—PARTIAL ILEECTOMY (FIG. 32)

1. The high mid line incision scar was excised to enter the upper abdomen. Palpation and inspection revealed a fist sized recurrent carcinomatous mass in the mid transverse mesocolon and infiltrating the colon wall to produce stenosis and partial obstruction. In the lower descending colon was another but smaller carcinomatous mass, also constricting the lumen. In the upper jejunum there was a focus of neoplastic infiltration of the mesentery near the bowel and extending into the bowel wall itself for a distance of several centimeters. In the lower ileum a similar lesion was found over a shorter segment. It was obvious that the upper abdominal mass was a recurrence in the previous operative field, but the gastrojejunal anastomosis itself was free from tumor. The lesions in the small bowel and in the lower colon were gravitation metastases, primary in the mesentery near the bowel and involving the latter by lymphatic permeation. The bowel wall in the involved segments was thickened and firm and covered with fibrinous exudate; the appearance suggested regional ileitis. No hepatic or other peritoneal metastases were found.

2. The involved segment of the upper jejunum and its mesentery were excised; side to side enteroenterostomy was carried out.

3. The involved segment of the lower ileum and its mesentery were excised with end to end anastomosis.

4 The hepatic flexure was mobilized by division of the hepatocolic ligament and the colon was transected just distal to the flexure The base of the transverse mesocolon was divided along its entire length, including division of the middle colic vessels where they emerge from beneath the neck of the pancreas

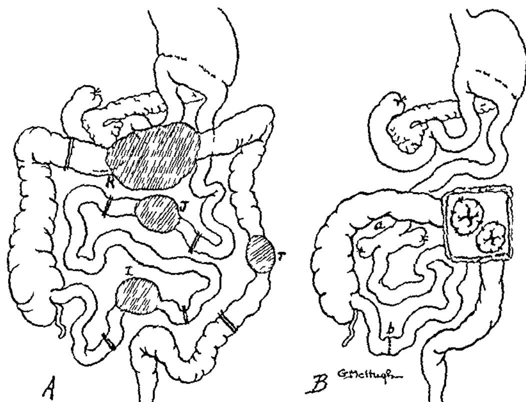


FIG 32 – Case 6 (239588) A diagram of metastases (gravitational [?]) within abdomen following partial gastrectomy 2 years earlier R large metastasis in transverse mesocolon surrounding segment of colon T smaller metastasis in descending colon J metastasis involving upper jejunum I metastasis in lower ileum The metastases appeared to have originated in mesentery near the segments of bowel and to have extended into the bowel wall There was obstruction at each site of metastases The lines of transection for resections are shown B termination of operation by enteroenterostomies (a side-to-side and b end to-end) and colostomy following removal of most of transverse and descending colon Colostomy closed 6 weeks later Marked palliative result Patient engaged in heavy work for 2 years and then exhibited evidence of recurrences Died of carcinomatosis 2 years and 3 months after operation

5 The colon was transected at the junction of the descending and sigmoid portions Resection was made of most of the transverse colon omentum splenic flexure and entire descending colon with recurrent neoplasms

6 The proximal and distal loops of the remaining colon were brought through a stab incision to the left of the mid line incision as a double barrel colostomy The mid line incision was closed in layers The colos

tomy was thus formed by the colon just distal to the hepatic flexure and the colon of the upper sigmoid loop

The surgical specimens (Fig. 33) consisted of 50 cm of colon with the omentum bearing the two carcinomatous masses mentioned above 35 cm of the jejunum bearing a carcinomatous mass and 15 cm of the ileum

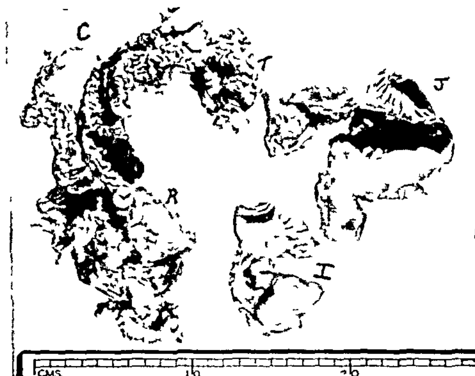


Fig 33 —Case 6 (230588) Formalin hardened surgical specimens from operation depicted in Figure 32 C most of transverse and descending colon R large tumor mass in transverse colon T smaller mass in descending colon J segment of jejunum and I segment of ileum both involved by metastases

with its carcinomatous mass In the latter two specimens there were ulcerations in the mucosa The smaller carcinomatous mass in the lower descending colon also ulcerated through to the mucosa The large mass in the transverse mesocolon did not extend through the bowel wall to cause ulceration Histologic study revealed all lesions to be carcinomas of very anaplastic type

Convalescence was uneventful The patient was discharged 23 days after operation with colostomy functioning normally The latter was closed 6 weeks later The patient returned to work and worked continuously without discomfort He eventually gained 25 pounds in weight

In December 1943 after a voyage as pilot of a Great Lakes ore steamer he returned ashore and suddenly felt quite ill complaining of general abdominal pain cramplike in character He rapidly lost weight over a period of 3 weeks because of loss of appetite Ingestion of a small amount of food induced severe cramping abdominal pain there was distention and frequent vomiting of bile stained fluid He was readmitted to the hospital where examination of the abdomen revealed a deep mass in the left umbilical region and a small hard nodule in the wall just to the right of the umbilicus There was no distention or ascites at this time There was no cervical adenopathy or evidence of pulmonary metastases on x ray examination

Exploratory laparotomy performed January 3, 1944 revealed a large mass of recurrent carcinoma in the root of the mesentery of the small bowel Resection was impossible because practically the entire superior mesenteric artery was surrounded by neoplastic tissue Extensive upper abdominal adhesions precluded direct visualization of the right lobe of the liver these adhesions were not divided Coursing transversely in the upper abdomen there was a fixed segment of distended small bowel this was not mobilized The left lobe of the liver was inspected and palpated and there was no evidence of metastases The abdomen was closed after biopsy of the nodule in the abdominal wall to the right of the umbilicus

Following the operation the patient was nourished entirely by vein (glucose gelatin and casein digest) for 3 weeks There were no symptoms of obstruction and he was fairly comfortable Small oral feedings were then permitted and fluids (dextrose and saline) were given by vein as needed He continued to be fairly comfortable and even after ingestion of food did not develop the distressing symptoms of obstruction that he had had prior to operation Asthenia and cachexia gradually progressed and he literally faded away, dying on March 10, 1944 Necropsy revealed extensive carcinomatosis in the retroperitoneal nodes but there was *no gross evidence of hepatic or pulmonary metastases* This is another instance of the prolonged course of carcinoma without liver and lung metastases and such findings again afford encouragement for the resection of as much neoplastic tissue as feasible at laparotomy when liver metastases are not apparent

In some instances secondary operation may be performed to excise carcinoma that is known to have remained *after a primary operation* and when obstructive symptoms have not yet developed Obviously such excisions will be very infrequent and the following is an example

Case 33—N (311069) male 43 years Admitted on the medical service June 30 1943 Typical ulcer syndrome for 3 years with relief by food or alkalis *Gastric* analysis (histamine) 81 clinical units of free acid Roentgenograms of the stomach revealed a large

filling defect at the incisura After a period of 7 days hospitalization he was discharged at his own request Medical management was not faithfully carried out as an ambulatory patient and did not afford regression of the lesion during a period of 4 months although symptoms were partially relieved Because of the persistent roentgenographic evidence of the gastric lesion he was advised to undergo exploratory laparotomy

Radical gastrectomy (Billroth II) was performed on October 6 1943 for excision of what was considered at the time to be a penetrating ulcer of the posterior aspect of the pylorus The penetrating portion rested upon the upper anterior aspect of the head of the pancreas After the stomach had been elevated the ulcer crater was separated by sharp dissection from the head of the pancreas The tissue about the crater itself was not more than 2 or 3 mm in thickness was very firm and some of it obviously remained adherent to the pancreas

Convalescence was satisfactory and the patient was discharged on October 10 1943 His appetite returned and there were no complaints

Histologic study of the resected portion of the stomach revealed the ulcer to be carcinomatous and it was therefore evident that the resection of the ulcer from the head of the pancreas was not radical enough to have sufficiently encompassed the growth Because the patient s general condition was good and at the previous operation no evidence of metastases was observed a second operation to remove the tissue that previously was densely adherent to the neoplasm was performed as follows on November 20 1943 6 weeks following the first operation

PANCREATODUODENECTOMY (FOR SECONDARY CARCINOMA IN HEAD OF PANCREAS)

The previous laparotomy scar was excised to enter the upper abdomen The head of the pancreas was surrounded by dense adhesions which were divided No regional lymph node or hepatic metastases were encountered The site of the previous adhesion of the ulcer to the head of the pancreas was very firm suggesting the presence of carcinoma and appeared to have contracted into the head of the pancreas The peritoneum was incised along the greater curvature of the duodenum, and the latter with the head of the pancreas was elevated to the left This permitted direct inspection of the lower common duct It appeared contracted although not apparently involved by tumor The gall bladder was normal and contained no stones The neck of the pancreas was transected just to the right of the superior mesenteric vein and the stump was sewed over with interlocking silk mattress sutures The main pancreatic duct was isolated and ligated The terminal portion of the duodenum was transected and the distal end invaginated by purse string sutures In this manner the head of the pancreas and the duodenum were resected after transection of the lower seg

ment of the common bile duct The stump of the latter was closed by a transfixion suture and also a ligature The first long loop of jejunum distal to the gastrojejunostomy was brought through a hiatus in the transverse mesocolon, and a cholecystojejunostomy was performed using two rows of interrupted silk sutures A jejujejunostomy was performed between afferent and efferent loops of jejunum below the level of the transverse colon The abdomen was closed with two soft rubber drains to the site of excision

In general a choledochojejunostomy is preferable to cholecystojejunostomy because of the danger of reopening the ligated common duct resulting in fatal bile peritonitis if the abdominal wound has healed or a biliary fistula if this occurs before it has healed However, in this patient the lower segment of the common bile duct, as stated was markedly contracted for no apparent cause, and it was felt that such a small duct would probably have stenosed still further had it been utilized for anastomosis, with resultant biliary obstruction

In studying the surgical specimen, which consisted of the duodenum and the head of the pancreas the site of dissection of the carcinoma of the stomach from the head of the pancreas appeared as a whitish firm, oval plaque, depressed in the center Sections taken from this area showed acute inflammation foreign body reactions due to sutures and new granulation tissue but no carcinoma cells were apparent (serial sections were not made) The carcinoma cells may have been present but may not have been recognizable in the new granulation tissue

The postoperative course was at first, satisfactory However in 2 months the patient was readmitted for drainage of a large deep, upper abdominal abscess and after discharge he was fairly comfortable for a brief period and was ambulatory Subsequently, instead of gaining weight he became progressively cachectic He had one or two stools a day that appeared normal for the most part but occasionally they were clay colored and bulky He received bile salts and pancreatin by mouth but the latter appeared to induce nausea at times and was discontinued Finally a firm indurated area appeared about the site of the previous drainage of the deep abscess that clinically gave the impression of a carcinoma metastasis

Death occurred on March 21 1944, at home 4 months after the second excision Necropsy was not obtained

In the series of 3 patients described above subjected to operation for

recurrent carcinoma of the stomach, one died of complications of the operation 1 month later, one died 4 months after the operation, the progress of the original disease not having been affected, and one, in almost critical condition at the time of the secondary operation, survived 2 years and 9 months, during which period, except for the last 3 months, he enjoyed excellent health and engaged in a rather strenuous occupation (sailor and later pilot of a Great Lakes ore steamer).

GASTRECTOMY FOR METASTATIC CARCINOMA TO THE STOMACH

Gastrectomy for metastasis to the stomach from a malignant neoplasm arising elsewhere in the abdomen is usually not envisaged, inasmuch as the patient's condition at this stage has usually deteriorated to such an extent that only a brief survival can be anticipated. The writer on two occasions has performed gastrectomy for metastases to the stomach from a malignant process arising elsewhere in the abdomen. In one instance the primary growth was in the pancreas and the metastases to the stomach wall were probably lymphogenous; the patient—Case 36 (325186)—is recorded in chapter XII. A summary of the second patient is presented as follows:

Case 39.—Bayl (3[illegible]), white male, 67 years of age. This patient was first seen in the Medical Clinic January 4, 1944. He complained of epigastric pain, periodic diarrhea and generalized weakness of 8 months' duration. The epigastric pain was intermittent and burning in character and not necessarily related to eating or bowel movements. The diarrhea consisted of several frothy stools a day for several days, then periods of regularity. No cause for this was apparent. At the time that he was admitted he had lost 20 pounds of weight during the previous several months. General examination was negative. Roentgenograms of the colon and terminal ileum revealed no abnormalities.

The attending physician reassured the patient that there was no evidence of organic disease. Under proper dietary regime he *gained 10 pounds* and exhibited general improvement for a period of 4 months. He then experienced an acute attack of epigastric pain, diarrhea, nausea and vomiting. He was admitted to the hospital on the medical service for x-ray study of the stomach, the latter not having been previously carried out. Numerous small calcified stones were seen in the gall bladder region, and a constant protruding deformity with smooth margins was seen near the pylorus on the greater curvature. The latter was interpreted as being a small papilloma or carcinoma. The writer then saw the patient in consultation and laparotomy was advised. This was performed on May 5, 1944, as follows:

PARTIAL GASTRECTOMY (POLYA) FOR SECONDARY MALIGNANT NEOPLASM, CHOLECYSTECTOMY, OMENTECTOMY (TOTAL)

When the abdomen was entered through a high mid line incision, carcinomatosis was obvious; there was no excess free fluid. The peritoneal surfaces were everywhere studded with whitish firm nodules, the retroperi

toneal nodes were enlarged, discrete and firm. There were several discrete metastases in the liver not exceeding 3–4 mm. in diameter. Palpation in the porta hepatis revealed a deeply situated firm mass in the liver arising posterior to the terminal portions of the right and left hepatic ducts. On the greater curvature of the stomach, about 4 cm. proximal to the pylorus there was a rounded firm tumor mass *3 cm. in diameter imbedded in the* gastric wall, about which the serosal vessels were markedly congested. This growth was obviously metastatic but seemed to infiltrate into the lumen and conceivably could be the cause of painful pyloric spasm and hemorrhage and later possibly obstruction. The gall bladder wall was moderately thickened and contained numerous small stones. The abdomen was thoroughly explored including the pancreas and the adrenals. No primary site was revealed. The two foci for production of symptoms appeared to be the gall bladder and the pylorus. Accordingly, a cholecystectomy and partial gastrectomy (long loop—anterior Polya) were performed. The entire greater omentum which contained numerous small metastases and involved nodes was also resected (Fig. 34).

Study of the resected two thirds of the stomach showed that the secondary tumor that was near the pylorus and described above did actually ulcerate through the mucosa. The gall bladder contained over sixty small rounded and faceted concretions. The omentum was studded with many metastases and contained numerous small, but firm lymph nodes.

Microscopic study revealed (*a*) chronic cholecystitis and (*b*) that the neoplastic masses in the wall of the stomach, omentum and numerous nodes were composed of irregular shaped tubules lined by tall columnar malignant epithelial cells. As stated, the primary site was not ascertained at laparotomy but could have been in the bile ducts since the largest tumor mass was palpated in the porta hepatis.

The patient was discharged ambulatory on the twentieth day postoperative and was able to retain food. He volunteered the statement that there was no pain in the abdomen and that his "bowels *felt better*" than prior to the first admission to the medical outpatient department 4 months previously. At home his condition was fairly satisfactory for a month but later, cachexia and abdominal pain were progressive and he died 2 months after the operation.

Partial gastrectomy for metastases *in the gastric* wall from carcinoma arising elsewhere was not primarily envisaged in the two cases reported above. It was performed once the abdomen was open and carcinomatosis

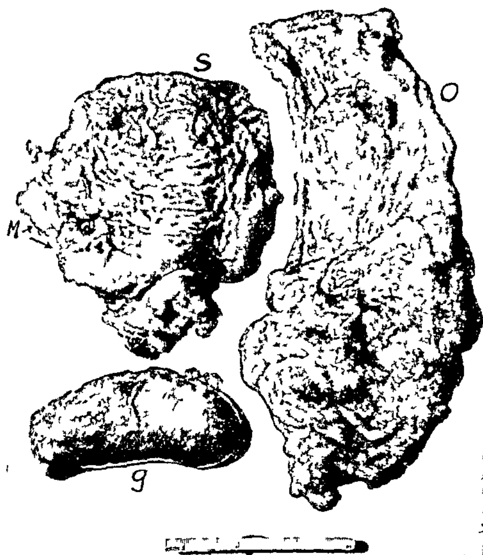


Fig 34 —Case 30 (324602) Surgical specimens consisting of *O* practically entire omentum riddled with metastatic carcinomatous nodules *G* gall bladder which contained numerous small concretions *S* lower two-thirds of stomach (the metastatic nodules on serosa are not seen) *M* metastatic mass in wall of stomach which caused deformity on fluoroscopy Primary growth not discovered at laparotomy Patient had had severe abdominal pain and frequent vomiting prior to operation and was relieved after laparotomy General condition remained fairly satisfactory for 1 month after operation asthenia and cachexia then rapidly developed and death occurred 2 months after operation

was found with secondary lesions in the stomach that might have produced symptoms The resections that were carried out were undertaken as part of the procedure to remove as much tumor tissue as possible Neither of these patients died as a result of operation and the experiences are too limited to warrant tentative *conclusions inasmuch as carcinomatosis was* too extensive to have permitted more than brief survival anyway

While reoperation for recurrent gastric carcinoma might appear to be an overly radical, unorthodox, and unjustified procedure, the result obtained in one of the three cases cited in this chapter was so satisfactory that the author will continue to consider this in suitable instances This principle is not a new one Walters *et al* refer to 24 instances of reoperation in gastric cancer performed in the Mayo Clinic prior to 1935 in 151 patients who had previously had a Billroth I type of resection The second operation was performed because of recurrent obstruction due to recurrent carcinoma, and the incidence of this complication is cited as evidence against the type of operation (which now of course is rarely performed for carcinoma) At the second operation in this series short circuiting procedures were sometimes performed to relieve the obstruction One patient is cited in whom gastric resection for carcinoma (Billroth I) was performed in 1923 and who, when seen in 1934, again presented a carcinomatous lesion in the lower stomach (recurrence or new lesion), which was resected with Polya type anastomosis He survived the latter operation for more than 1 year

CHAPTER IX

OPERATIONS FOR ADVANCED CANCER OF THE SMALL INTESTINES

PRIMARY malignant neoplasms of the duodenum are rare. An interesting and unsolved question is the frequency with which carcinoma develops just above the pyloric sphincter and the rarity with which it develops distal to it in the first 12 inches of the small bowel (duodenum). Stewart and Lieber reviewed the 103 cases of carcinoma of the duodenum reported in the segment above the level of the ampulla of Vater up to 1937 and added 6 of their own. Recently Cohn reported 2 instances of carcinoma of the supra-papillary portion of the duodenum diagnosed preoperatively. In one instance resection was carried out but the patient died 3 months later. In the other instance resection was not attempted but gastroenterostomy was performed for palliation; the patient died postoperatively of complications. Exact localization of carcinomas of the first part of the duodenum by roentgenographic examination would appear to be difficult. The deformities, if present, would be considered by the roentgenologist to be in the terminal portion of the pylorus, since such lesions are relatively common in contrast to their rarity in the first segment of the duodenum. Burke *et al.* have recently recorded 1 case of carcinoma of the first portion of the duodenum that survived over 5 years. Shackelford *et al.* excised the first half of the duodenum and a small portion of the subjacent head of the pancreas for myosarcoma of the former. The operation was terminated by ligation of the common bile duct, cholecystgastrostomy and Billroth I gastroduodenostomy. The patient received palliation and died 9 months later. Instances of small neoplasms of the duodenum and confined to this segment of bowel will not be considered here, since they would not now be regarded as inoperable because of location in view of recent developments in the surgery of this region.

The following is an example of carcinoma of the first segment of the duodenum with direct invasion of the subjacent portion of the head of the pancreas.

Case 19.—H. (219683), white female, 56 years of age. This patient had had pernicious anemia for several years with marked neurologic disturbances in the lower extremities

resulting in inability to walk Because the blood picture finally revealed a microcytic hypochromic anemia carcinoma of the stomach was suspected and barium fluoroscopy revealed an annular ulcerating lesion thought to be in the pylorus (diagnosis made before abdominal symptoms developed by Dr Leon Jacobson of the medical service)

PARTIAL DUODENOPANCREATECTOMY AND PARTIAL GASTRECTOMY (FIG 35)

Laparotomy was performed on October 8, 1942 A firm mass was discovered in the first portion of the duodenum immediately distal to the pyloric sphincter and attached to the upper anterior portion of the head

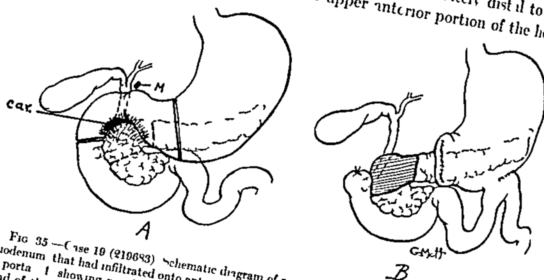


Fig 35 —Case 19 (210683) Schematic diagram of resection of carcinoma car of first portion of duodenum that had infiltrated onto anterior superior aspect of head of pancreas M metastatic node in porta A showing neoplasm and lines of transection B showing completion of operation The head of the pancreas was split in the vertical plane the raw surface being indicated by shaded area The large pancreatic ducts and common bile duct were not injured There was no pancreatic fistula after operation Patient lived in comfort for 11 months and then presented signs and symptoms of recurrent carcinoma At a second laparotomy excision of the recurrences was attempted but the hepatic artery was resected with the tumor and the patient succumbed shortly after operation In retrospect a radical one stage pancreatoduodenectomy should have been performed as the first operation

of the pancreas There were large firm lymph nodes in the periaortic region above the pancreas and one in the porta hepatis Resection was performed according to the usual technique for gastrectomy (approximately half of the stomach was removed) and the duodenum was transected at the junction of the first and second portions The head of the pancreas was split vertically to remove en masse with the above its anterior and superior aspects which latter were involved by neoplasm In sectioning the head of the pancreas large pancreatic ducts were not encountered and the termination of the common bile duct was not observed Following resection the several firm and enlarged lymph nodes

were removed from the anterior aspect of the aorta above the pancreas and one large firm node was dissected off the anterior aspect of the portal vein The continuity of the alimentary tract was re established by a posterior Billroth II gastrojejunostomy

Study of the surgical specimen confirmed the fact that the carcinoma (3 cm in diameter) was primary in the first segment of the duodenum and had infiltrated into the head of the pancreas but not beyond the level

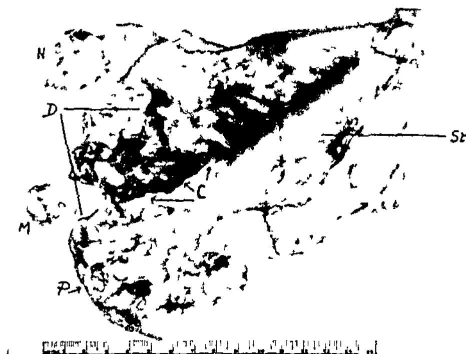


Fig 36—Case 19 (219683) Surgical specimen obtained from operation shown in Figure 35 and consisting of St lower stomach D first and upper segment of second portion of duodenum containing C carcinoma in first portion of duodenum P anterior half of head of pancreas M metastatic node resected from porta hepatis N metastatic nodes from about pylorus

of resection (Fig 36) Histologic study revealed the lesion to be adenocarcinoma which had metastasized to the resected adjacent lymph nodes Convalescence was uneventful and the patient was discharged on the nineteenth postoperative day During the months that followed there were no complaints and a varied diet was consumed However on September 27 1943—11½ months after the above operation—the patient was readmitted because of a palpable epigastric mass She also complained of gaseous distention after meals The clinical impression was recurrent abdominal carcinoma There were no ascites and the liver was not palpable

At laparotomy on September 30 1943, recurrent carcinoma was encountered in the head of the pancreas, extending upward into the porta hepatis A radical pancreatoduodenectomy was performed to excise the cancerous head of the pancreas and its extensions In freeing the extensions of the neoplasm into the porta hepatis, the hepatic artery, which was surrounded by tumor, was inadvertently transected and ligated The operation however, was completed but the patient did not recover consciousness (general anesthesia had been employed) and died 7 hours later necropsy was not permitted

AMPULLA AND PERIAMPULLAR REGION

Carcinomas of the ampulla of Vater or the periampullar region usually, but not always produce high grade biliary obstruction when still quite small Ampullar and periampullar carcinomas are more frequently observed than carcinomas of other segments of the duodenum These may be excised by pancreatoduodenectomy (see chap xi) when there is evidence of invasion of the head of the pancreas or if they are of moderate to large size but do not exhibit gross evidence of invasion of the head of the pancreas When quite small (0 5 cm or less in diameter) transduodenal excision with reimplantation of bile and pancreatic ducts into the duodenum may be performed

In view of the recent developments in the surgery of this region, large tumors should now be resected very radically However in one instance of large carcinoma of the ampulla infiltrating through the duodenal wall local resection with reimplantation of bile and pancreatic ducts has afforded prolonged survival

Case 78—Helf (186022) female 41 years of age Admitted November 17 1937 *because of diarrhea—6-7 stools a day at frequent intervals for 2 years* Easily fatigued 3 years loss of 10 pounds weight over 2 year period Physical examination was negative except for a palpable nontender mass about 6 cm in length to the right of the umbilicus. Under observation the diarrhea was observed to be steatorous in nature R B C 3,500 000 Hb 78% W B C 7 000 Roentgenograms showed a large (Fig 37) irregular filling defect in the duodenum interpreted as neoplasm Cholecystograms were negative Laparotomy was performed November 26 1937 as follows

TRANSDUODENAL RESECTION OF LARGE AMPULLAR CARCINOMA REIMPLANTATION OF COMMON BILE AND PANCREATIC DUCTS

1 The abdomen was entered through a high mid line incision There was no evidence of carcinomatosis or hepatic metastases The lower half of the duodenum was enlarged to a sausage like mass 8 cm in length and about 4 cm in diameter The walls were edematous and injected

2 The upper abdomen was walled off with large pads and a longitudinal incision was made parallel to the long axis of the duodenum on its anterior aspect and corresponding to the second and upper portions of the *third segment of the duodenum* The edges were retracted and an ulcerating bulging mass was exposed attached to the posterior and mesial aspect of the duodenal wall The papilla of Vater was not apparent as such and it was assumed to be involved by the tumor



Fig 37 —Case 78 (180022) Preoperative roentgenogram of barium fluoroscopy showing *S* stomach *D* first segment of duodenum *T* large filling defect due to carcinoma arising from inner border of second portion of duodenum Transduodenal approach resection of tumor and duodenal wall reimplantation of common bile and pancreatic ducts Patient is well 7 years later

3 The mass was grasped in the left hand and transection of its base from left to right was carried out including the entire thickness of duodenal wall about the base At the termination of the dissection there was a gush of bile and clear fluid from separate points in the right extremity of the wound The whole posterior duodenal wall had been cut away and the exposed freshened head of the pancreas was seen to be grossly normal In the right extremity of the wound the transected common bile duct and pancreatic duct were seen

4 The ducts were reimplanted into the duodenal wall and the wounds were closed as shown in Figure 38

5 Closure of the abdomen was made without drainage The surgical specimen weighed 54 gm and is shown in Figure 39 Obviously the ampulla was included in the tumor, which apparently first arose in the duo

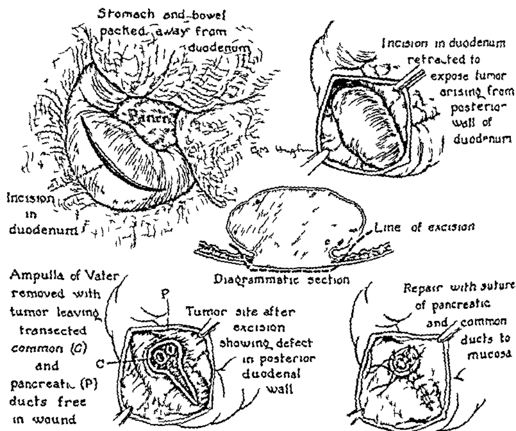


FIG 39 —Case 79 (180099) Showing transduodenal excision of large carcinoma of second portion of duodenum together with posterior duodenal wall infiltrated by tumor Common bile and pancreatic ducts reimplanted Patient living and well 7 years later

denum below it While the ampulla was not recognized grossly as such probes could be passed easily through the excised lower segments of common bile and pancreatic ducts and these were found to be in the proximal portion of the growth A striking feature is that there was no obstructive icterus before operation Microscopic sections showed the tumor to be a small cell medullary carcinoma that had infiltrated the musculature of the duodenal wall almost into the subjacent pancreatic tissue

The postoperative course was uneventful and the patient was discharged on the twentieth day

Since then she has been well and active as a public health nurse There

are no complaints except for periodic loose stools passed especially in the morning Seven years after operation the patient remains well without evidence of metastases

The satisfactory result obtained in this patient is an example of the occasional good result obtained when malignant neoplasms that have not

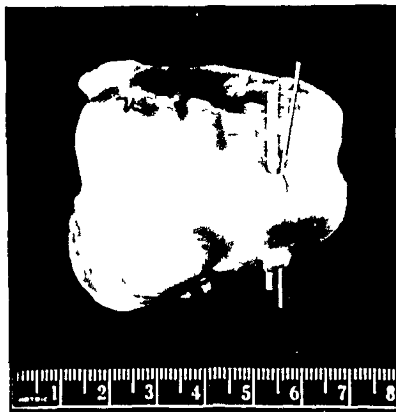


Fig 39 —Case 78 (186092) Photograph of carcinoma of duodenum which involved ampulla and which was resected transduodenally Wooden and metal probes in pancreatic and common ducts respectively U ulceration on surface of tumor protruding into duodenal lumen The tumor had also extended completely through duodenal wall

metastasized are resected locally even though such local resections appear at the time to be inadequate to afford lasting control of the growth Such cases add encouragement for the operative attack of all malignant growths in the abdomen regardless of location and size when there is no gross evidence of metastases

The radical excision of the duodenum and the head of the pancreas may be carried out in the presence of limited metastases although biliary short circuiting operations for relief of jaundice may afford palliation where metastases are extensive Lymph node metastases in the immediate

vicinity of the neoplasm if these are the only ones apparent, may be resected individually. The following is an example of pancreatoduodenectomy performed in the presence of metastases in the nodes about the head of the pancreas and in the presence of a large metastatic node in the porta hepatis which was dissected off the anterior aspect of the portal vein separately.

Case 10.—N. G. (2648), white male, 55. Admitted April 7, 1943. He had been well until 9 months previously when there had been icterus with pain for 6 weeks. The icterus cleared and again developed 5 weeks prior to admission accompanied by anorexia and loss of 15 pounds weight. There was at this time no abdominal pain. Roentgenographic examination revealed a constant deformity along the medial aspect of the second portion of the duodenum probably due to carcinoma of the head of the pancreas. Physical examination was negative except for icterus—the icteric index was 49, plasma proteins 6.00 gm. per cent, blood glucose 98 mg. per cent. The stools contained occult blood. The clinical impression was carcinoma of the ampullary region (because of painless jaundice; carcinoma of the head of the pancreas is usually accompanied by epigastric pain).

Pancreatoduodenectomy was performed May 17, 1943, as described in chapter xi. The nodes immediately adjacent to the duodenum and about the head of the pancreas were enlarged and firm. There was a *solitary* spherical firm metastatic node in the porta hepatis, lateral to the common bile duct below the cystic duct and adherent to the right lateral border of the portal vein. This was resected separately. There were no liver metastases or *evidence of peritoneal dissemination*.

Study of the resected duodenum and the head of the pancreas (Fig. 40) revealed an oval discoid, ulcerating carcinoma in the duodenum obviously arising from the ampulla, measuring 7.5×4×3 cm. A probe inserted into the lower common duct passed easily through the center of the lesion into the duodenal lumen. The head of the pancreas itself was not invaded by the carcinoma. The solitary metastatic node from the porta hepatis was 2.5 cm. in diameter. Microscopic sections showed the neoplasm to be a duct cell carcinoma (tall columnar epithelial cells). Sections from four lymph nodes including the one mentioned above from the porta hepatis showed metastatic carcinoma.

Convalescence was relatively uneventful, except for a deep wound abscess which necessitated drainage. There was a fistulous tract at the site of the drain to the excision site *from which there* was a serous discharge that was not pancreatic juice. He was discharged from the hospital 2 months after operation having been kept in longer than necessary for metabolic studies because the external pancreatic secretion was occluded

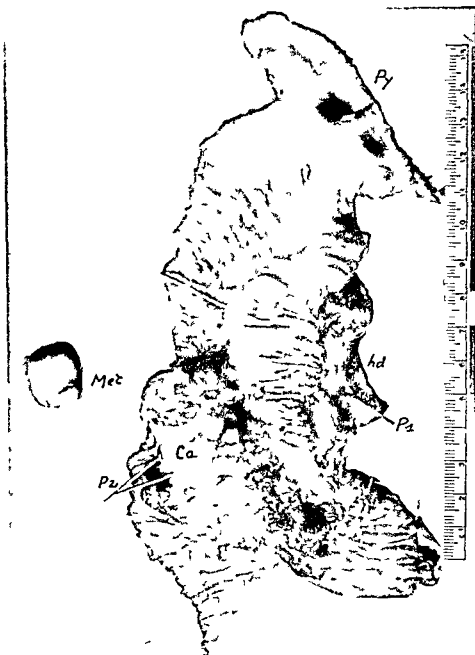


Fig 40 —Case 10 (2648) Surgical specimen obtained from one-stage pancreatoduodenectomy for large carcinoma of ampulla *Ca* lower end of pylorus *Py* head of pancreas *hd* metal probe P_1 in duct of Santorini metal probes P_2 extruding from lower end of common duct and main pancreatic duct in center of tumor mass *Met* lymph node metastasis from porta hepatis Patient well and at work 2 years and 10 months after operation



FIG. 41.—Case 61 (290018). Surgical specimen obtained from one-stage pancreatoduodenectomy. There was large carcinoma of ampulla (within duodenum C–C') that had metastasized to *RL*, regional lymph nodes. *HN*, metastatic node resected from porta hepatis, and single metastatic node in liver, *HM*, resected from left lobe. *P*, pylorus; *H*, head; and *N*, neck of pancreas, respectively. *D*, duodenum. Immediate recovery from operation was very satisfactory. Died tenth day from uremia. Necropsy revealed no hemorrhage or peritonitis. Kidneys showed acute glomerulonephritis. Icterus was not severe prior to operation.

The stools were light colored and pasty. When known amounts of fat were given in the diet and stools were analyzed for fat on two occasions the results were as follows:

Period I, 7 days	480 gm. fat ingested 29 gm. fat in stools 451 gm. fat absorbed = 94% of fat ingested
Period II, 5 days	484 gm. fat ingested 12.5 gm. fat in stools 471.5 gm. fat absorbed = 97% of fat ingested

Because of the lymph node metastases and the fistula which persisted for several weeks after operation, a moderate amount of x-ray therapy was given to the upper abdomen (calculated dose in the pancreas = 702 r.). The fistula subsequently closed.

Three years and six months after operation the patient remains well and is back at work as a bookbinder. There are one or two light colored pasty stools a day. There is no icterus. The normal degree of fat absorption and the bulky nature of the stool are not consistent findings and cannot be explained. Protein metabolism also appears normal in that no recognizable undigested meat fibers are seen in the stool after ingestion of 1 pound of raw ground beef, and the plasma proteins were 6.36 gm. per cent 7 months after operation. The question of digestion after occlusion of pancreatic secretion and excision of the duodenum is considered in greater detail in chapter XI.

In another patient – Case 61 (290018), with mild jaundice—pancreatoduodenectomy for large ampullar carcinoma was performed in one stage with resection of a large metastatic node in the porta hepatis and a single hepatic metastasis in the left lobe (Fig. 41). Convalescence was uneventful until the eighth day when uremia developed and resulted in death on the tenth day. Necropsy revealed no hemorrhage, peritonitis, or gross evidence of residual carcinoma. Microscopic sections showed acute glomerulonephritis. This was not a typical hepatorenal death as icterus was not marked, there was no fever, and the urinary output was not diminished.

Carcinomas of the infra-papillary portion of the duodenum, that is, developing below the ampulla of Vater, have been much less frequently observed than carcinomas developing above this level. Lieber, Stewart and Lund reported 28 cases collected from the literature up to 1937 and added 2 instances of their own. An obstructing lesion of the lower duodenum was visualized roentgenologically with a fair degree of accuracy

in 40 per cent of 15 cases, in 33 per cent the lesion was incorrectly localized at or near the pylorus and in the remainder no lesion was demonstrated Of the 20 cases in which operative attack was reported 17 died shortly after operation, 2 were alive 3 months after operation 1 of whom had evidence of metastases and the ultimate course of 1 was not recorded

Carcinomas of the terminal portion of the duodenum and invading the head of the pancreas are treated by resection of the entire head of the

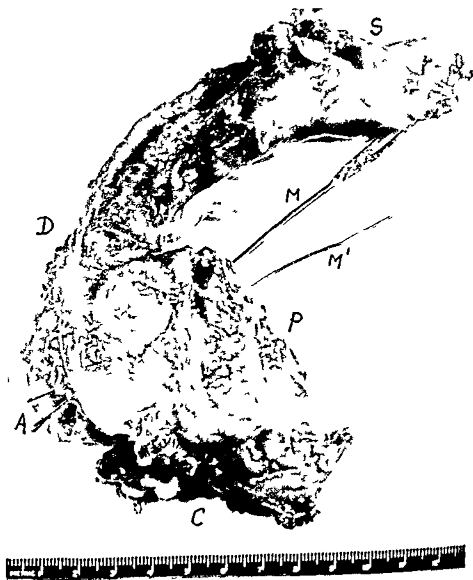


Fig 42—Case 97 (351103) Surgical specimen consisting of S pylorus D entire duodenum with C carcinoma of third portion infiltrating P the lower margin of the head of the pancreas M metal probe in lower common duct and M′ wire probe in main pancreatic duct Both probes protruding from ampulla

pancreas and duodenum (pancreatoduodenectomy see chap xi) Figure 42 shows the surgical specimen from Case 97 (351103) consisting of the lower pylorus the entire duodenum and the head of the pancreas the inferior border of which is infiltrated by a carcinoma arising in the third segment of the duodenum

When the neoplasm is situated a short distance below the ampulla and especially when it invades the adjacent portion of the head of the pancreas it may be treated as a carcinoma of the ampulla by radical resection of the duodenum and the head of the pancreas When the neoplasm is situated in the terminal portions of the duodenum resection (including the adjacent portion of the head of the pancreas) may be feasible without sacrifice of the papillary region and the entire head of the pancreas as in the following instance

Case 14 —J (142731) white male 43 years old Massive hemorrhage from the alimentary tract in 1935 splenectomy elsewhere in 1936 for Banti s disease —anemia continued Exploratory laparotomy was again performed elsewhere in 1940 at which time the gall bladder was removed and a lymph node excised from above the pancreas which histologically showed spindle cell sarcoma —metastatic There was another exploratory laparotomy in 1942 in another institution at which time a tumor involving lower duodenum was discovered and nothing done because the growth was pronounced as inoperable Abdominal pain continued and severe secondary anemia persisted He was admitted to the hospital June 28 1942 with marked anemia and a history of several recent massive hemorrhages from the bowel (black stools) Barium fluoroscopy revealed an ulcerating polypoid lesion in inferior portion of duodenum Final laparotomy was performed July 21 1942 as follows

PARTIAL PANCREATODUODENECTOMY —JEJUNODUODENOSTOMY (FIG 43)

1 A high mid line incision was made with lateral extension 4 cm in length (L incision)

2 Numerous adhesions were encountered in the upper abdomen and these were divided

3 When the duodenum and the head of the pancreas were exposed a large double fist sized tumor mass apparently cystic in nature was found attached to the lower segment of the second and the third portions of the duodenum and extending backward beneath the lower portion of the head of the pancreas Palpation of the duodenum in this region revealed an ulcer crater with raised rolled edges about 2½ cm in diameter corresponding to the site of attachment (or origin) of the tumor mass to the duodenum No hepatic or peritoneal metastases were noted but there were four enlarged and firm nodes along the greater curvature of the duodenum

4 The inferior aspect of the tumor mass was closely associated with the superior mesenteric vessels The latter were freed by sharp dissection and then elevated to the left

5 The peritoneum along the convex border of the duodenum was incised and the duodenum and the head of the pancreas were elevated after some difficulty because of adhesions

6 The lower portion of the common bile duct was inspected and found free of invasion by tumor A small Payr clamp was applied transversely

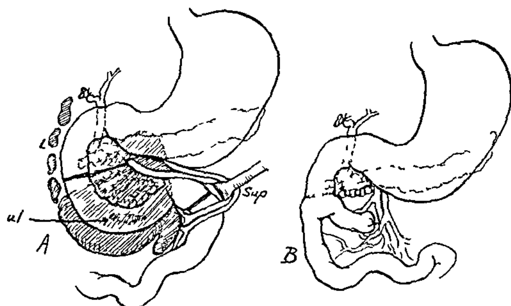


Fig 43 —Case 14 (142751) A schematic representation of spindle-cell sarcoma involving lower portion of duodenum with *ul* ulceration into it and into lower portion of head of pancreas and extending backward into retroperitoneal space *I* lymph node metastases along greater curvature of duodenum *Sup* superior mesenteric vessels freed and elevated from tumor *B* termination of operation lower half of duodenum resected together with first few centimeters of jejunum lower portion of head of pancreas and entire neoplasm with metastatic nodes Duodenojejunostomy Main pancreatic ducts lower common duct and ampulla of Vater not disturbed (gall bladder previously resected) Patient well and normally active 2 years and 5 months after operation no evidence of recurrence or metastases

across the second portion of the duodenum at a level thought to be below the ampulla This clamp was passed to the left in order to cross the mid portion of the head of the pancreas Kocher clamps were applied below the Payr clamp and the duodenum and the lower half of the head of the pancreas were transected

7 The ligament of Treitz was divided and the duodenojejunal junction was transected The jejunal end was invaginated

8 By carrying the dissection backward the tumor mass which measured 11×7×3 5 cm was freed completely and removed together with

the inferior portion of the head of the pancreas its uncinate process the lower half of the second portion and the entire third portion of the duodenum

9 The Payr clamp was removed from the second portion of the duodenum The crushed pancreatic parenchyma was sewed with interrupted interlocking silk mattress sutures When the duodenum was opened and its contents were aspirated the papilla of Vater was found barely 1 cm above the line of transection

10 Duodenojejunostomy end to side was then performed between the second portion of the duodenum and the first portion of the jejunum mobilized to the right This anastomosis was carried out with two rows of interrupted silk sutures care being exercised to avoid inclusion of the papilla in the suture line

11 Large soft rubber drains were placed at the tumor site and the abdominal wound was closed

The surgical specimen (Fig 44) referred to above in step 6 was opened and found to consist of a cystic mass containing blood clots and necrotic tissue surrounded by a wall of dense tumor tissue This cystic space communicated with a large ulcer in the lower second portion of the duodenum 3×1.5 cm It was evident that this was the site of the repeated gastrointestinal hemorrhages which had kept the patient anemic The segment of duodenum attached to the tumor was 12 cm in length The attached inferior half of the head of the pancreas measured 5×3 cm Several large lymph nodes were included in the specimen Histologic study revealed the neoplasm to be a large spindle cell sarcoma the nodes all contained metastases It was not possible to conclude finally whether the neoplasm was primarily duodenal or was primarily a retroperitoneal sarcoma with secondary invasion and ulceration into the duodenum

Convalescence was uneventful except for a brief period of icterus due undoubtedly to edema of the papilla of Vater in view of its close proximity to the suture line in the anastomosis

The patient remained well and was normally active and without evidence of disease for 3 years He then returned for another laparotomy because of a large abdominal mass The latter was excised but there were diffuse hepatic metastases He died one month later

An instance of lymphosarcoma involving the entire duodenum follows

Case 68 —J Mart (331831) male 63 years of age The patient a Lithuanian could not give a good history because of language difficulties He was admitted to the hospital on

April 19 1944 in a markedly asthenic state and fainted while walking to his bed A few hours later he had an emesis of 3 000 cc of dark brown material Apparently his appetite had failed recently and there was purported to have been a 30 pound weight loss during the preceding month ( ) Physical examination revealed a markedly emaciated male of about stated age There were no abnormal masses palpable W B C 9 300 Hb 9 gm

Roentgenograms revealed a dilated stomach and complete obstruction in the terminal portion of the duodenum There were irregularities in the walls of the duodenum and abnormal rigidity The impression was Obstruction in duodenum due to neoplasm



FIG 44 —Case 14 (142751) Surgical specimen from operation shown in Figure 43 consisting of resected large spindle-cell sarcoma T involving wall of lower half of duodenum D and infiltrating head of pancreas (resected portion of head of pancreas not shown in photograph) U ulceration of neoplasm into third portion of duodenum P portion of neoplasm dissected away from superior mesenteric vessels Metastatic lymph nodes also resected not shown in photo

Continuous suction of the stomach was carried out The problem in this patient was a complex one His extreme debility and high intestinal obstruction obviated adequate nutritional preparation He was in no condition even for a relatively minor procedure The question of jejunostomy for feeding was considered but although recommended by some authors under such circumstances has not proved to be very successful in the writer's experience Intravenous nutrition was instituted The patient received daily 500 cc of 5 per cent gelatin solution 2 000 cc of 5 per cent casein digest and 5 per cent glucose and 1 000 cc of 10 per cent glucose in normal saline This afforded the equivalent of 104 gm of protein 200 gm of carbohydrate and 15 gm of sodium chloride a day The latter was desirable because of obviously frequent copious vomiting prior to admission and because of

the excessive loss of electrolytes resulting from continuous gastric suction. The theoretical caloric value of the injected fluid was 1,416 calories (casein digest 300 calories, gelatin 316 calories, glucose 800 calories). Since the patient weighed 41.8 kg., this represented slightly more than 33 calories per kilogram, an adequate intake for a subject confined to bed. The plasma proteins on admission were 8.0 gm. per cent, but this high value was due to hemoconcentration.

The patient improved rapidly on this regime, which was maintained for 12 days. On the fifth day there was a chill and rapid rise in temperature to 104 F.; this returned to normal in 2 days, but roentgenograms of the chest revealed a minimal bronchopneumonia in the left lower base, with minimal fibrous pleuritis in the left costophrenic angle.

The patient's urine (he had no stools) was collected at 24 hour intervals and analyzed for total nitrogen. The regime outlined above afforded a daily positive nitrogen balance averaging 1 gm.

On the twelfth day of hospitalization the patient's condition appeared to be optimum under the circumstances, and in spite of the lesions in the chest, intervention was decided upon the next day. The chemical analyses of the blood were within normal ranges. Accordingly, laparotomy, under continuous spinal anesthesia, was performed as follows, May 1, 1944.

PANCREATODUODENECTOMY, ONE STAGE

1. High midline incision.

2. Exploration revealed a mild diffuse cirrhosis of the liver and no evidence of metastases. There was no excess free fluid and no evidence of peritoneal metastases. The entire duodenum was markedly enlarged, to about 5–7 cm. in diameter. The muscularis was edematous, and the subserosal vessels congested. Palpation gave the impression that it contained moderately firm tissue throughout almost its entire extent. The common bile duct was only slightly enlarged. There was a single enlarged and firm lymph node just below the cystic duct.

3. Pancreatoduodenectomy (see chap. XI) was performed in one stage. The stomach was transected just above the pylorus, and the upper end was invaginated by two rows of interrupted sutures. The common bile duct was transected posterior to the first portion of the duodenum. The neck of the pancreas was transected, the main pancreatic duct ligated, and the pancreatic stump closed by interrupted mattress sutures. The duodenojejunal junction was divided, and the jejunal end was closed by two concentric purse string sutures. The entire duodenum and the head of the pancreas were thus resected. The large node near the cystic duct was resected.

4. The continuity of the alimentary tract was re-established by gastrojejunostomy (posterior Billroth II), and choledochojejunostomy was performed about 15 cm. distal to the above anastomosis.

5 The abdomen was closed with three large soft rubber drains—one to the site of the excision one to the right kidney fossa and one to the upper portion of the lesser peritoneal sac

The resected duodenum was opened along the convex border Throughout most of its course the mucosa was replaced by large grayish moderately firm papillomatous structures (Fig 45) The ampulla was not identified until a probe was inserted through it via the stump of common duct There was no obstruction in the ampulla The first and last few centimeters of duodenal mucosa were not involved by the lesion The head of the pancreas was not invaded by neoplasm Microscopic sections revealed "large round cell sarcoma"—probably lymphosarcoma And sections of the lymph nodes removed from the porta revealed metastases

The immediate postoperative course was satisfactory although the temperature rose to 104° F (rectal) the night of operation During the following 7 days the temperature varied from 99° to 102° F (rectal) The patient appeared at first to be in good condition Parenteral nutrition was continued Beginning on the fourth day he was permitted 50 cc of liquid nourishment by mouth at hourly intervals for 12 hours each day Pulmonary edema was manifested on the third day and intravenous infusions were reduced Nasal oxygen was administered continuously On the sixth day the general condition became worse and the patient responded poorly to questions Sulphathiazole had been administered and the circulating plasma level (free) was 7 25 mg per cent The pulse became much weaker on the evening of the seventh day and he expired at 5 00 A M on the eighth day

Necropsy revealed no peritonitis there was an accumulation of purulent material at the resection site but it was being drained and there was no evidence that this was the cause of death The latter was obviously due to bronchopneumonia especially in the left lower base There were several small pulmonary abscesses probably due to aspiration of vomitus prior to admission

The above patients afford examples of the fact that if the entire duodenum is resected the head of the pancreas must also be resected because of its intimate apposition to the duodenum On the other hand partial duodenectomy may be performed with resection of only that part of the head of the pancreas corresponding to it The first segment of duodenum is amenable to resection with only a small portion of the underlying head of the pancreas If it is a question of the terminal segment of the duo-



Fig 45 —Case 68 (331831) Lymphosarcoma involving entire duodenum Specimen obtained by one-stage pancreatoduodenectomy Head of pancreas under specimen and not seen in photograph *P* Lower portion of pylorus Metal probe in main pancreatic duct showing patency of ampulla of Vater (patient did not have icterus)

denum, only the lower portion of the head of the pancreas need be excised with the preservation of the papilla of Vater and terminal portions of the lower common bile and the main pancreatic ducts

JEJUNUM AND ILEUM

The mobility and length of the small bowel facilitate extensive resections following which anastomoses may be readily performed especially when the neoplasm to be resected is well below the duodenojejunal junction Malignant neoplasms arising from the first portions of the jejunum may infiltrate backward into the relatively short mesentery Where the degree of spread of the neoplasm does not afford a contraindication, resection of the involved bowel its mesentery, and local extension are carried out as in the following patient

Case 1 —E C (134969) white female 65 years of age Entered the hospital because of generalized weakness vague abdominal pain and loss of 10 pounds weight in 2 months There was palpitation and dyspnea on exertion General physical examination and roentgenologic examinations of the alimentary tract were negative R B C 1 920 000 Hb 32 per cent W B C 4 600 Occult blood was consistently present in the stools Because of the latter finding the physician in charge made the diagnosis of probable small bowel neoplasm and exploratory laparotomy was advised This was performed on September 11 1936 as follows

PARTIAL JEJUNOPANCREATECTOMY END TO END ENTEROSTOMY GASTROENTEROSTOMY (FIG 46)

1 The abdomen was entered through a high mid line incision A tumor mass arising in the first loop of the jejunum 8 cm distal to the ligament of Treitz was found This involved about 6 cm of the bowel and produced little constriction although a rather large papillomatous mass was palpated inside the lumen There was infiltration of neoplasm into the mesentery of the jejunum and by direct extension from this into the tail and distal portion of the body of the pancreas and into the retroperitoneal tissues posterior to this No metastases were found

2 Transection of the jejunum was made 4 cm distal to the ligament of Treitz and a second transection 4 cm distal to the tumor End-to-end anastomosis of the jejunum was carried out after the involved portion of jejunal mesentery had been isolated and also mobilized with the specimen

3 Transection of the distal portion of the body of the pancreas proximal to invasion by the jejunal neoplasm was then performed the fresh stump being sewed over by interrupted interlocking mattress sutures The jeju

nal segment and its mesentery with tumor and involved portion of pancreas and retroperitoneal spread were removed en masse

4 In view of the assumption that local recurrences were likely to develop and produce obstruction a posterior gastrojejunostomy was performed using a site in the jejunum 10 cm distal to the end to-end anastomosis

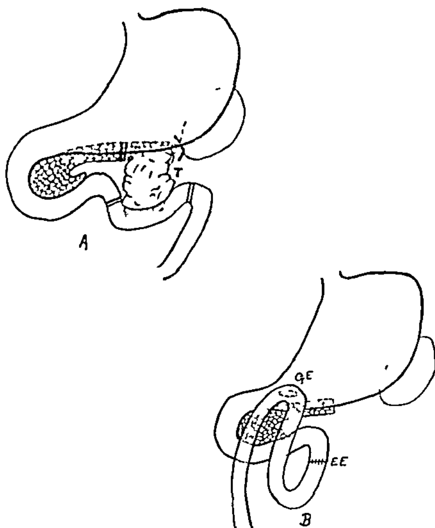


Fig 46 —Case 1 (134969) A carcinoma of first loop of jejunum T with direct extension into its mesentery and into distal portion of body of pancreas and retroperitoneal tissues lines of transection for excision are shown B neoplasm and extensions have been excised (including tail of pancreas) EE end to-end enteroenterostomy Because of the fact that these anastomosed ends were not far from the primary growth and its extra intestinal extensions a local recurrence was anticipated This would have produced obstruction therefore a gastroenterostomy GE was performed distally Patient alive and well 10 years and 8 months after operation

The surgical specimen is shown in Figure 47 Microscopic sections showed carcinoma

Convalescence was uneventful and the patient still remains well 10 years and 3 months after operation, without evidence of recurrence



FIG 47—Case 1 (134969) Formalin hardened surgical specimen obtained from operation shown in Figure 46 C papillomatous carcinoma in first portion of J jejunum that has extended upward into M mesentery and into distal portion of body and tail of P pancreas and into retroperitoneal tissues T behind pancreas Patient alive and well 8 years and 2 months after operation

Large neoplasms usually sarcomas may be encountered involving considerable segments of small bowel and corresponding portions of the mesentery The bulky nature of such growths is characteristic of lymphoblastoma or leiomyosarcoma The latter arises in the bowel wall and involves mesentery by direct extension Lymphoblastoma or round cell sarcoma may arise in the mesentery and involve the bowel secondarily or may arise in the bowel and extend into mesenteric nodes but these

questions are of academic interest only in so far as surgical treatment is concerned. Carcinomas of the small bowel do not usually attain large size but produce widespread metastases relatively early in their development. Multiple small bowel carcinomas are not extremely infrequent. Bulky masses involving segments of the small bowel are sometimes interpreted as sarcoma but subsequent study of the resected specimens reveals that they are inflammatory masses and not neoplasms. Such lesions of relatively limited size may, in reality, be localized forms of regional ileitis.

The following is an example of an extensive resection for sarcoma involving the small bowel and mesentery.

Case 28.—Lew (H2084). Chinese male, 30 years of age. The principal complaints were lower abdominal pain, nocturia and frequency, and loss of 25 pounds weight in the previous 4 months. An exploratory laparotomy in another institution had revealed an inoperable tumor. On physical examination there was a large spherical mass in the lower abdomen, and above this there were visible peristalsis. The superficial lymph nodes in the groin and axilla were not enlarged. The differential blood count was normal. Laparotomy was performed as follows.

PARTIAL ENTEROCYSTECTOMY FOR MASSIVE LOWER ABDOMINAL TUMOR (FIG. 48)

1. A low midline incision was made extending 6 cm. above the umbilicus.

2. Exploration revealed a large spherical mass situated in the lower abdomen and involving the mesentery of the upper ileum; over its surfaces loops of ileum were adherent, with one large segment apparently involved within the mass.

Exploration of the upper abdomen revealed a firm disk-shaped tumor mass 3 cm. in diameter in the fundus of the gall bladder. No hepatic metastases were apparent. Several enlarged discrete lymph nodes were present in the mesentery of the jejunum.

3. Cholecystectomy was performed because of a neoplasm in the fundus of the gall bladder.

4. The peritoneal reflections to the right and left of the mass were incised in order to free its upper and lateral aspects, together with adherent loops of small bowel.

5. In separating the peritoneum over the inferior lateral aspects it became apparent that the neoplasm had extended downward to involve the major portion of the dome of the urinary bladder. Accordingly, a circular incision was made through the bladder to free the dome. The bladder was closed by two layers of interrupted mattress sutures.

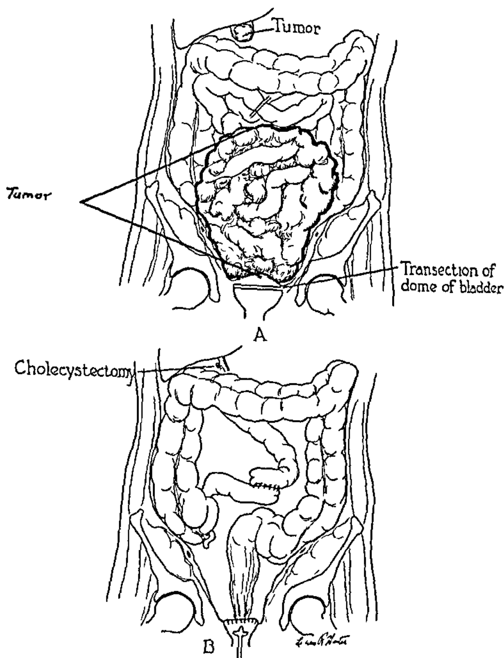


Fig 48 —Case 28 (312089) A diagrammatic representation of massive sarcoma involving loops of ileum and lower retroperitoneal tissues with infiltration of dome of urinary bladder Lines of transection in upper ileum and bladder are shown *B* termination of excision of tumor together with 75 cm of small bowel and cholecystectomy for metastasis Continuity of ileum re-established by side-to-side anastomosis Most of urinary bladder removed Pezzar catheter inserted

6 The neoplasm with the adherent upper portion of the bladder was freed over its inferior aspects and posteriorly being elevated from the anterior surfaces of the aorta the inferior vena cava and the right and left common iliac veins and arteries The ureters were identified and after elevation of the mass were found to be intact

7 The ileum several centimeters above and below the neoplasm was transected the ends invaginated and a side to side anastomosis performed The tumor and the involved loops of bowel were removed

8 The abdomen was closed with a soft rubber drain to the gall bladder bed and one to each side of the pelvis lateral to the repaired bladder

Immediately after closure of the abdominal wound had been completed a retention catheter was inserted into the urinary bladder via the urethra

Study of the surgical specimen which was a rounded, solid tumor mass weighing 1 200 gm revealed it to include approximately 75 cm of the ileum (Fig 49) In the central portion the neoplasm had replaced all macroscopic evidences of bowel so that for a distance of approximately 18 cm the continuity of the alimentary tract was maintained by a passage through tumor tissue This suggested its origin from bowel wall Histologic study showed round cell sarcoma The discoid mass in the fundus of the gall bladder also proved on histologic examination to be a round-cell sarcoma

The patient s convalescence was uneventful up to the nineteenth day when chills and fever developed lasting for 6 days and subsequently recurring at intervals owing presumably to urinary infection Because histologic examination revealed the tumor to be a lymphosarcoma x ray therapy was administered but was without apparent benefit

The patient died on the forty seventh day following operation General asthenia was markedly aggravated all desire for food was lost and there was extreme cachexia Necropsy was not performed

Another instance of resection (partial) of a sarcoma involving a relatively large segment of the lower ileum is cited below Here there was a large abscess within the tumor and drainage of this in itself appeared to afford temporary relief from pain

Case 21 —Hor (304059) white male 41 years of age In July 1949 he developed a severe burning pain in the right lower quadrant accompanied by urinary frequency He was admitted to another hospital and an appendectomy performed for drainage of an abscess and removal of a ruptured appendix The wound healed rapidly and for 10



Fig. 49. Case 28 (312089). Surgical specimen weighing 1,200 gm. from operation depicted in Figure 48. Massive lymphosarcoma involving lower loop of ileum. *B*, dome of urinary bladder; *G*, gallbladder with metastatic neoplasm in fundus. The resected specimen included 75 cm. of ileum but the adherent loops of bowel not extensively invaded by tumor have been cut away and are not shown in the photograph.

weeks thereafter he felt well. In November 1942 he noted excessive borborygmi in the abdomen and pain in the right lower quadrant. There was an acute seizure of severe pain accompanied by chills and high fever. He was again admitted to another hospital where aspiration of the alimentary tract was performed (Miller-Abbot tube). A mass was palpated in the right lower quadrant. He was discharged and remained at home for some 10 weeks, when he was again admitted to the same hospital and an operation performed through the rectum with removal of tissue. During the ensuing months he consulted several different physicians for persistence of the mass in the right lower quadrant and persistent burning pain in this region. On March 3, 1943 he was admitted to this hospital stating that he had lost 15 pounds during the previous 5 months, that he had had chills and fever, and that the pain in the right lower quadrant was more or less constant with exacerbations which sometimes awakened him from sleep. There were periods of urinary frequency. Temperature 100.1 (oral). W.B.C. 16,000. R.B.C. 3,000,000. Palpation of the abdomen revealed a deeply situated, rounded, immovable mass in the lower portion of the right lower quadrant. Rectal examination revealed a mass filling the hollow of the sacrum; it appeared to be continuous with the mass in the right lower quadrant. The lumen of the bowel did not appear to be encroached upon. Roentgenograms revealed no evidence of pulmonary metastases; roentgenograms of the pelvis showed no skeletal abnormalities.

The clinical impression was probable malignant neoplasm in the lower retroperitoneal space.

Laparotomy was performed on March 11, 1943 as follows:

PARTIAL RESECTION OF SARCOMA OF ILEUM AND DRAINAGE OF INTRATUMORAL ABSCESS

1. Right lower paramedian incision.

2. A large nodular tumor mass was immediately revealed, arising in the retroperitoneal spaces of the right lower quadrant and extending downward into the hollow of the sacrum. The over-all measurements were about 20×15 cm. The lower ileum was closely attached to the mass by virtue of the latter's having infiltrated the leaves of the mesentery of this portion of the bowel. There were no liver metastases. There were large discrete masses in the retroperitoneal spaces of the upper abdomen. Palpation of the main mass in the right lower quadrant revealed deep fluctuation.

3. The mesial aspect of the mass in the right lower quadrant was denuded of peritoneum, and the rest of the abdomen was protected with pads. Incision was made into the mass and about 200 cc. of thick yellow pus was liberated and sponged away as quickly as possible.

Three masses of tumor tissue, the largest 6×4×4 cm., were resected to facilitate complete drainage of the inner portion of the mass. A large soft rubber drain was inserted into the cavity that remained, and the

upper portion of the abdominal wound was closed in layers The lower portion was left open to permit drainage

Histologic study of the resected tumor tissue revealed leiomyosarcoma (probably originating from the wall of the lower ileum)

The postoperative course was satisfactory, there were no clinical disturbances due to intra abdominal infection However, on the third day a fistula from the ileum developed in the wound This was not subsequently accompanied by general untoward reactions The patient received x ray therapy to the region from March 25 to April 7, 1943, a total tissue dose" in the depth of the tumor being estimated at 1 450 r He was discharged on the twenty eighth postoperative day, feeling well, and complaining of little or no pain in the lower abdomen During the final 10 days the temperature remained normal except for an occasional rise to 100° F (oral) He was seen in the outpatient clinic at intervals for the ensuing 3 months The mass in the lower abdomen did not decrease appreciably in size as compared with its size on discharge although it was definitely smaller than before operation The ileal fistula continued to drain although there were bowel movements per rectum at times He stated that he felt much improved, as compared with his condition prior to the last operation and that he enjoyed his meals

During August and the first part of September he became weaker although he continued to be ambulatory On September 15, 1943, he was admitted to another institution and given further x ray therapy to the abdomen The abdominal wound became larger cachexia developed and pain recurred He died on October 30, 1943—7½ months after the last operation

An interesting feature of this case is the question of whether or not the episode of appendicitis was in reality the onset of symptoms due to the tumor which was not recognized as such at the time Also the question of abscess formation within the tumor is of interest as this may have resulted from the appendectomy or from the biopsy per rectum performed some months previously

Usually drainage of infected tumors within the abdomen is not purposely carried out but in this instance the abscess was unusually large and its evacuation afforded some measure of relief It did not result in rapid spread of the tumor into the anterior abdominal wall

In connection with advanced neoplasms of the small bowel the surgical

problem is not that of resection of long segments of it but rather the resection en masse of the primary growth which does not often involve long segments with its spread to contiguous structures It has been stated that adequate nutrition may be maintained with 50 per cent of the small bowel intact and that removal of 70 per cent is feasible but entails risks of subsequent difficulties in adequate nutrition Still greater portions of the small bowel may be resected with survival in good nutritional state provided that such resections are carried out in stages

CHAPTER X

OPERATIONS FOR ADVANCED CANCER OF THE COLON

THE symptoms associated with advanced carcinoma of the colon may be distressing indeed and in an attempt at palliation radical surgical procedures are often justified rather than simple short circuiting operations

In the writer s experience colostomy above an "inoperable rectal carcinoma that is bleeding profusely at intervals and that is also the cause of diarrhea and frequent rectal tenesmus does not always afford the desired palliation These patients may continue to discharge copious quantities of purulent and hemorrhagic mucus from the anus and the tenesmus may persist Where the patient s condition is still at least fair and where the above symptoms are pronounced, combined abdominoperineal resection in one stage does afford considerable relief from the local symptoms *This may be performed in some instances, even though multiple* hepatic metastases are present as in the following patient

Case 37 —M Fent (327461) *male 25 years of age steel worker* Admitted to the hospital complaining of 45 pounds loss in weight intermittent constipation and diarrhea then continuous diarrhea with gross blood and mucus in the stools 3 months duration There was also marked tenesmus and the patient stated *that he often went to stool 20 times a day* Rectal examination revealed the typical findings of a carcinoma at the tip of the examining finger The lesion was not mobile and was very tender on palpation Physical examination was otherwise negative Roentgenograms of the chest were negative Laparotomy was performed on March 4 1944

COMBINED ABDOMINOPERINEAL RESECTION IN THE PRESENCE OF MULTIPLE HEPATIC METASTASES

The abdomen was entered through *a low mid line incision* Palpation and inspection of the liver revealed numerous hepatic metastases each one however not larger than about 2 cm in diameter The peritoneum was smooth and presented no metastases There was no excess free fluid in the peritoneal cavity There were no enlarged retroperitoneal lymph nodes In the mid portion of the rectal colon extending from about 6 cm above the peritoneal reflection of the cul de sac downward to well below the peritoneum was a firm mass obviously a carcinoma Adherent to its

upper portion and infiltrated by the growth was the redundant loop of the sigmoid (Figs 50 and 51) In order to eradicate the lesion which was the site of the patient's severe symptoms a typical one stage combined abdominoperineal resection was performed the end colostomy being brought through a stab wound in the left lower quadrant

Convalescence was uneventful The distress occasioned by severe tenesmus and rectal bleeding was completely relieved and the patient ad

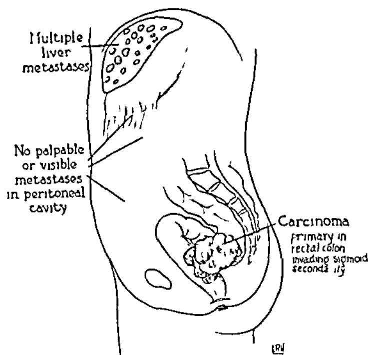


Fig 50—Case 37 (327401) Illustrating situation under which combined abdominoperineal resection was performed for palliative purposes Patient lived 8 months was ambulatory most of the time had no ascites and was relieved of severe rectal tenesmus

mitted subjective general improvement in his condition The appetite was good He was discharged on the twenty first day postoperative During the following 4 weeks he gained 10 pounds in weight Upper abdominal pain developed due presumably to metastases and x ray therapy (tumor dose 1 400 r) was given to the liver During this period there was frequent nausea The latter subsequently disappeared but high girdle pain continued This was not greatly distressing since the gain in weight was maintained appetite was good and he was quite active physically The upper abdominal pain subsequently became more pronounced necessitating increased doses of sedatives General physical activity however remained



Fig 51.—Case 37 (327461) Surgical specimen consisting of S lower sigmoid R rectal colon and A anus obtained from combined abdominoperineal resection Carcinoma primary in rectal colon C was adherent to and infiltrated loop of sigmoid higher up at point S producing communication into lumen There was severe tenesmus in anal colon hence in spite of multiple hepatic metastases the resection was carried out Palliative response

unimpaired and by the end of the fifth month after operation there were no ascites or evidence of carcinomatosis except for palpable nodules in the liver which latter appeared only slightly enlarged as compared to the situation 4 months previously [1]

Combined abdominoperineal resection under the circumstances described above should be performed only when the primary growth may be well encompassed by the operation In many instances simple colostomy above the growth will be followed by relief of local symptoms with periods of gain in weight and general well being Such periods of palliation may last for several months or even a year or two or longer in exceptional circumstances

Extensive experience has led to the development of a wide variety of procedures for radical partial colectomies Total colectomies have also been performed for intractable inflammatory disease and extensive polyposis In connection with radical surgical removal of malignant neoplasms the problem is not so much that of wide resection of the colon itself as of resection en masse of the involved segment with the direct extensions of the neoplasm Apart from metastases it is the extensions to neighboring viscera and tissues that have often caused these neoplasms to be regarded as inoperable

Carcinomas of the cecum or ascending colon may have spread to the anterior or posterior abdominal wall or may have involved both these parietes when encountered at operation In extending posteriorly, the ureter and the kidney may be involved Excision of the right ureter and kidney en masse with the cecum the ascending colon and the right half of the transverse colon is readily performed after incision of the parietal peritoneum along the right gutter of the abdominal cavity The procedure is terminated by ileotransverse colostomy

The following is an instance of rather extensive involvement of the right lower abdominal wall by carcinoma of the cecum

Case 15—C B (255457) white male 48 years of age Admitted to the hospital on January 13 1941 complaining of pain in the right lower quadrant anorexia 15 pounds weight loss during the previous 2 months and occasional vomiting for 6 weeks A year previously an appendectomy had been performed in another institution for persistent right lower quadrant pain but this operation did not relieve the symptoms On physical

[1] The patient remained ambulatory until the seventh month after operation he then spent much of the day in bed He was finally admitted to the hospital very asthenic and cachectic The cachexia had developed rapidly Shortly after admission icterus developed and rapidly became intense the liver was very large and nodular He expired 8 months after operation Necropsy revealed massive hepatic metastases there were no metastases in the lungs

examination an oval mass was palpated beneath the appendectomy scar Barium fluoroscopy revealed a constricting lesion in the cecum

On January 22, 1941, laparotomy was performed through a low right rectus incision A tumor mass, about 8 cm in diameter, was found in the cecum (Fig 52, *A*), and several loops of ileum were adherent to it No metastases were present in the liver or over the peritoneum Numerous large firm lymph nodes were palpable in the mesentery of the lower small bowel and about the lower aorta One of these was removed for biopsy (it revealed metastatic carcinoma), and an ileotransverse colostomy was per

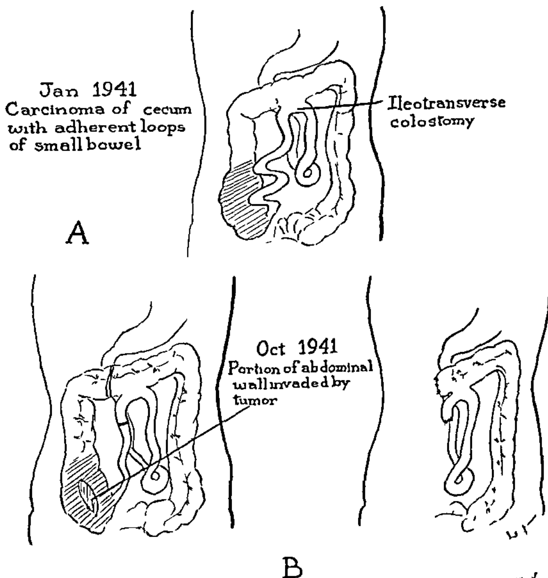


Fig 52 *A*, *B*—Case 15 (255157) Diagrammatic representation of operations for carcinoma of cecum (see text)

formed. Convalescence was uneventful and the patient was discharged on the seventeenth day postoperative. X-ray therapy was given to the right lower quadrant from February 6 to March 3, 1941 and from June 13 to July 9, 1941. There was 15–20 pounds gain in weight by June 1, 1944.

He was readmitted on August 4, 1941 complaining of severe right lower quadrant pain of 5 days' duration. Up to that time he had been quite active physically and had felt well except for a weight loss of 20 pounds since July 1, 1944. Examination of the abdomen revealed marked rigidity in the right lower quadrant over a mass and a chronic sinus in the old appendectomy scar. *The drainage was purulent and not fecal. Temperature 98.8° F.* W.B.C. 8,400. The sinus was spread open and, with drainage thus facilitated, the patient was discharged.

He was again admitted on October 5, 1941. The mass in the right lower quadrant was larger. The liver was not palpable and there was no evidence of ascites. On October 9, 1941, laparotomy was performed as follows:

EXCISION OF ABDOMINAL PARIETES WITH CECAL CARCINOMA. RIGHT HEMICOLECTOMY (FIG. 59 *B*)

A long elliptical incision was made in the right lower quadrant, 7 cm. at its greatest width. This included the skin of the lower right abdominal wall about the draining appendectomy scar, which was apparently adherent to the subjacent mass. The muscle and fascia of the abdominal wall between the skin and the deeper mass were also included in the incisions. When the abdominal cavity was entered, the cecal mass was found not to be adherent to the loops of small bowel as was the case at the first laparotomy. The site of the ileocolostomy was inspected and found to be free from tumor. Incision was made in the lateral peritoneal gutter and the cecal mass, ascending colon and hepatic flexures were mobilized. There were dense adhesions between the cecal mass and the muscles of the iliac fossa in the right pelvis; these were divided by sharp dissection. The transverse colon and ileum were divided just to the right of the ileocolostomy without *disturbing it and the transected ends of the transverse colon and the* ileum were invaginated. This permitted excision of the hepatic flexure, the ascending colon, the cecum with the carcinoma and the adherent portion of the abdominal wall of the right lower quadrant. Closure of the wound was difficult because of excision of skin, muscles and fascia of the abdominal wall. Extensive undermining of the layers about the wound finally permitted its closure under tension. Convalescence was uneventful.

During the late fall and winter of 1941–42 he traveled extensively, was active and felt quite well.

On June 15 1942 he was readmitted complaining only of a swelling in the right groin Examination revealed this to be several large firm inguinal nodes On June 16 a radical resection of these nodes en masse was *performed (Fig 52 C)* and he was discharged a week later Histologic study revealed metastatic carcinoma

On April 14 1943 the patient was again admitted complaining of lower abdominal pain nausea vomiting and intermittent diarrhea These symptoms had been present intermittently for a month Examination of the abdomen again revealed a large firm mass in the right lower quadrant which extended upward and toward the mid line to beneath the umbilicus The abdominal wall in the right lower quadrant was edematous and adherent to the mass The liver was not palpable and there was no evidence of ascites Roentgenograms of the chest were negative

June 1942
Resection of metastatic carcinoma of inguinal nodes
C

May 1943
Final resection of abdominal wall, invaded by tumor, and recurrent mass with loops of small bowel, segment of colon, kidney, and ureter
D

Fig 52C D—Case 15 (*continued*) Diagrammatic representation of operations for recurring carcinoma of cecum (see text)

On May 4 1943 laparotomy was again performed (Fig 52, *D*) An elliptical incision was made in the right lower quadrant to include that portion of the abdominal wall with scars that appeared to be adherent to the underlying mass When the abdomen was opened an irregular mass of tumor tissue about double fist size was encountered in the right iliac fossa Adherent to it were several loops of ileum The ileocolostomy was drawn downward and into the right iliac fossa and appeared to be surrounded by irregular neoplastic infiltration Large firm nodes were present in the mesentery of the small bowel extending upward to the origin of the superior mesenteric artery The mass infiltrated backward into the posterior abdominal wall surrounding the right ureter There were no hepatic metastases The mass was elevated by sharp dissection proceeding from the right lateral peritoneal gutter medially the right kidney the ureter the mass and several loops of small bowel adherent to it were freed en masse During the freeing of the mass from the posterior wall of the right pelvis the right common iliac vein was accidentally divided and ligated The left portion of the transverse colon was transected and invaginated The small bowel was transected at a level that appeared to be high in the ileum or in the lower jejunum and the end was invaginated A side to side ileodescending colostomy was performed after the mass described above was removed Closure of the abdominal wall was again difficult but was accomplished with much tension at the wound edges Five soft rubber drains were placed at different portions of the extensive excision site and brought out through the wound

Study of the surgical specimen (Fig 53) revealed it to include in addition to the irregular tumor mass the right kidney and the ureter an adherent portion of abdominal wall 86 cm of ileum and 29 cm of colon

The immediate convalescence was essentially uneventful The highest temperature was 101° F on the second day The right leg was cyanotic and cold on palpation for 3 days although not painful By the tenth day the wound had separated completely and was covered by a large pressure dressing By the end of the second week little food was being consumed and he was irrational at intervals although evidence of beginning wound healing was apparent His general condition remained only fair but the temperature and pulse were normal On the afternoon of the twenty third day postoperative he was found dead by the nurse The sudden demise was unexpected as convalescence had now appeared to have improved

Fig 53.—Case 13 (continued). Surgical specimen obtained from massive resection of recurrent carcinoma of cecum (operation depicted in Figure 52D). A, segment of involved skin and abdominal wall in right lower quadrant with underlying large carcinomatous mass; S, loops of adherent small bowel; K, right kidney resected because of involvement of ureter.

Necropsy revealed a coronary occlusion and also carcinomatous retroperitoneal lymph nodes The liver was still free from metastases

A review of this patient's history with the several operations might convey the impression that he was markedly debilitated during the 2 years and 3 months since first admission to the hospital This was not the case however since the only periods he was confined to bed were during the immediate postoperative periods He was physically active during most of his survival period and as stated made an extensive pleasure voyage during the winter of 1941-42 His appetite was good and he enjoyed eating The treatment of this patient was too conservative at the time of his first admission in that a short circuiting operation was performed instead of a massive resection

In another patient (Case 91 I [350135] a female aged 68) resection of peritoneal metastases and a portion of the abdominal wall infiltrated by carcinoma primary in the sigmoid and resected elsewhere was performed in a manner similar to but not so extensive as in the case described above Little palliation was afforded and the patient survived 4 months

Carcinomas of the colon in the region of the hepatic flexure may become adherent to the right lobe of the liver This is certainly no contraindication to resection Excision should be carried out with resection of the liver wide of the adherent portions as in the following patient

Case 7—*Zar* (9C3077) Mexican female 58 years old Admitted on June 4 1941 complaining of intermittent pains in the abdomen becoming more severe during the previous 3 months and associated at times with nausea and vomiting There was also a loss of 20 pounds in weight during this period General laboratory examination revealed that the patient was a mild diabetic In addition barium enema fluoroscopy revealed a large filling defect in the transverse colon just distal to the hepatic flexure

Laparotomy was performed on July 9 1941 as follows

RIGHT HEMICOLECTOMY WITH PARTIAL HEPATECTOMY (FIG 54)

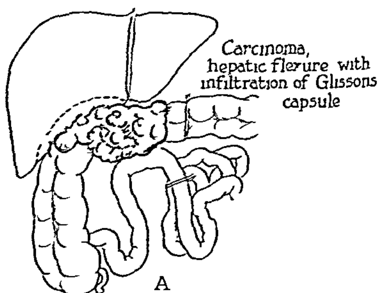
1 The abdomen was entered through a high paramedian incision which was then extended downward

2 A firm rounded tumor mass was encountered in the right transverse colon about 10 cm in diameter It was firmly adherent to the undersurface of the right lobe of the liver near its anterior margin No hepatic metastases were apparent The lowest long loop of ileum was adherent to the inferior surface of the mass

3 The lateral leaf of the peritoneum from the cecum and the ascending colon was divided to mobilize these segments of the bowel

4 Incisions into the liver parenchyma were carried out to encompass the portion of the liver adherent to the tumor, permitting this to be retracted downward *The fresh surfaces of the liver were closed with continuous mattress sutures Hemostasis was thus completed*

5 The transverse colon at the junction of the right three fourths with the left one-fourth was divided and the distal stump was invaginated The ileum several centimeters proximal to the loop adherent to the an



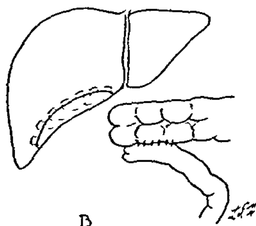


Fig 54 —Case [illegible] *A* showing carcinoma of hepatic flexure of colon with infiltration of anterior margin of right lobe of liver and infiltration of last long loop of ileum Lines of transection for excision of neoplasm and its extensions en masse are shown *B* after right hemicolectomy and excision of lower long loop of ileum with portion of right lobe of liver ileotransverse colostomy Excised liver edge sutured with running mattress suture

4 Incisions into the liver parenchyma were carried out to encompass the portion of the liver adherent to the tumor, permitting this to be retracted downward The fresh surfaces of the liver were closed with continuous mattress sutures Hemostasis was thus completed

5 The transverse colon at the junction of the right three fourths with the left one fourth was divided and the distal stump was invaginated The ileum, several centimeters proximal to the loop adherent to the an

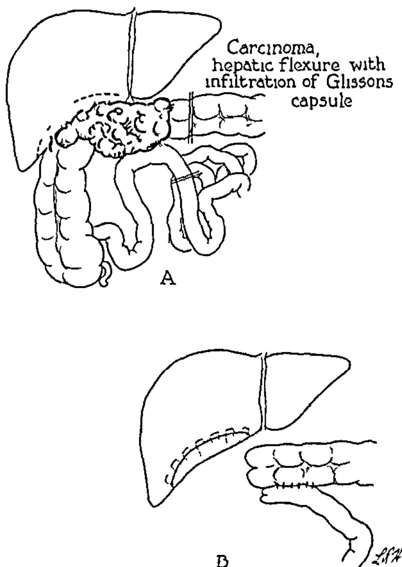


Fig. 54 Case 7 (263077) A, showing carcinoma of hepatic flexure of colon with infiltration of anterior margin of right lobe of liver and infiltration of last long loop of ileum Lines of transection for excision of neoplasm and its extensions en masse are shown *B*, after right hemicolectomy and excision of lower long loop of ileum with portion of right lobe of liver Ileotransverse colostomy Incised liver edge sutured with running mattress suture

terior aspect of the tumor mass, was divided and its upper segment closed A large portion of mesentery, corresponding to the right three fourths of the transverse colon the ascending colon, the cecum and the lower portion of the ileum was elevated isolated and removed with the aforementioned segments of bowel Approximately two thirds of the omentum was also resected

6 Side to side ileotransverse colostomy near the splenic flexure was performed

7 The abdominal wound was closed with a gauze pack to the site of the wound in the liver (such packs are not always necessary)

Study of the resected specimen (Fig 55) revealed that 68 cm of large and small bowel had been removed When the colon was opened the carcinoma was seen to arise a short distance beyond the hepatic flexure the tumor mass itself was not composed entirely of carcinoma but distal to it there was a dense crop of papillomata ranging in size up to 2 cm in diameter The colon just proximal to the tumor was considerably dilated, measuring 20 cm in circumference The segment of liver tissue adherent to the carcinomatous portion of the mass measured 9×3×3 cm Careful separation of the tumor from the liver revealed that Glisson s capsule was in reality densely adherent to the carcinoma but that actual infiltration into the liver parenchyma had not occurred The gross findings indicated that the carcinoma arose as a malignant degeneration of a papilloma

Histologic study of the specimen revealed adenocarcinoma Sections of many (30) lymph nodes revealed no evidence of metastases

Convalescence was essentially uneventful The patient was discharged on the twenty first day postoperative

Two years and 9 months later she returned to the medical outpatient department for management of her mild diabetes There was no evidence of recurrent or metastatic carcinoma and she had enjoyed excellent health after discharge following her operation maintaining 20 pounds gain in weight Three years and 4 months after operation there still is no evidence of recurrences as ascertained when she was admitted in diabetic coma After proper management she was discharged and has remained well for 5 years and 3 months

An unusual but not very rare mode of extension of carcinomas of the ascending colon or cecum is via the mesentery to involve the lower portion of the second segment of the duodenum In such instances the right colon

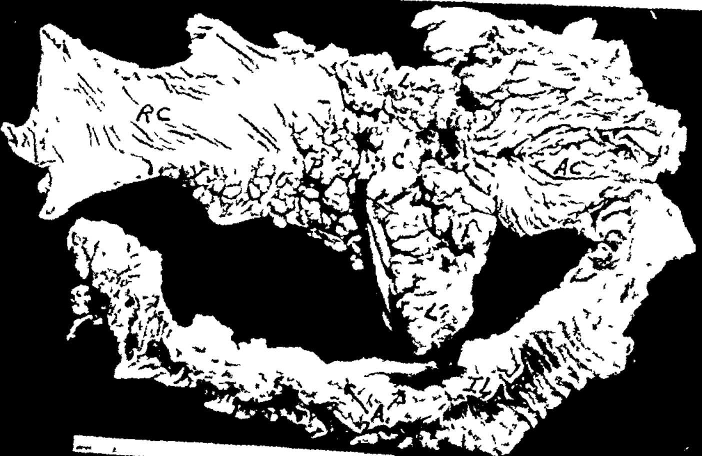


Fig 33.—Case 7 (263077) Surgical specimen consisting of RC right portion of transverse colon with P polyposis and C carcinoma, which has extended into margin of right lobe of liver. The segment of liver 9 cm long on undersurface (not seen here). The stretched-out appearance of specimen L-L is due to adherent AC ascending colon and cecum. IL lower ileum a segment of which was attached to the tumor in the colon but not actually infiltrated by it. Operation terminated by ileotransverse colostomy. Patient free from evidence of carcinoma 3½ years later

(lower ileum cecum ascending colon and right portion of the transverse colon) is mobilized together with corresponding mesenteries and incisions through the latter are carried to the area of involvement in the duodenum which is also freed en masse with the above This may necessitate end to end anastomosis of the duodenum or an elliptical segment of the duodenal wall is resected with repair by two rows of interrupted sutures (Case 81 [345079]) The operation is completed by ileotransverse colectomy

Carcinomas of the transverse colon when encountered at operation may have spread upward into the falciform ligament and via the lymphatics into the abdominal wall about the umbilicus On the other hand they may have extended backward in the gastrocolic ligament to invade the greater curvature of the stomach and into the transverse mesocolon finally reaching the body of the pancreas Examples of these situations are cited below

Case 90—W J (274498) white male 62 years of age Admitted to the hospital on November 27 1941 complaining of intermittent constipation and diarrhea of 1 year's duration Physical examination revealed a rounded mass in the upper midabdomen about 12 cm in diameter Barium enema revealed a large filling defect beginning in the mid transverse colon characteristic of carcinoma

Laparotomy was performed on December 12 1941 as follows

TRANSVERSE COLECTOMY—PARTIAL GASTRECTOMY RESECTION OF BODY OF PANCREAS AND SPLENECTOMY (FIG 56)

1 A high mid line incision was made A large carcinoma of the right portion of the transverse colon was found extending backward and rather firmly adherent to the lower portion of the stomach along the greater curvature and to the anterior aspect of the body of the pancreas Palpation and inspection of the liver failed to reveal evidences of metastases

2 It became evident that resection en masse of the tumor would entail removal of most of the transverse colon the body and tail of the pancreas the spleen and the lower half of the stomach

3 The pylorus was transected and the duodenal stump invaginated

4 The transverse colon was transected just distal to the hepatic flexure and just proximal to the splenic flexure The base of the transverse mesocolon was divided on each side up to the gross extensions of carcinoma from the colon onto the body of the pancreas The proximal and distal ends of the colon at each transection respectively were invaginated by purse string sutures

5 The tumor with the transverse colon and the stomach was retracted upward and to the left and a linen ligature was passed about the neck of the pancreas at the level of the superior mesenteric vessels This ligature included the splenic artery and vein The neck of the pancreas was transected just distal to the ligature

6 With the spleen as a handle the transverse colon bearing the tumor mass and the body of the pancreas were elevated out of the abdomen

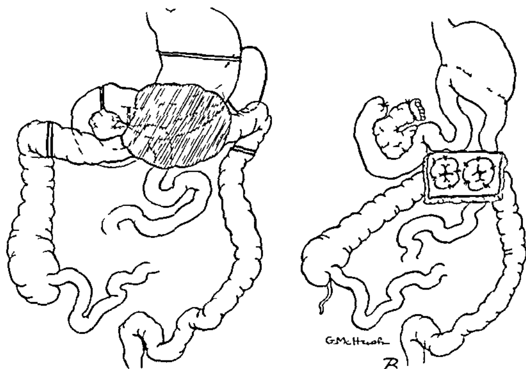


FIG 56 —Case 20 (274498) A showing massive carcinoma of transverse colon extending backward to infiltrate stomach and body of pancreas lines of transection on stomach and colon for excision of mass *B* showing situation at end of operation Transverse colon tumor lower three-fifths of stomach and body of pancreas resected Colostomy formed by hepatic flexure and upper descending colon Patient lived 3½ months relieved of obstruction and pain Death due to carcinomatosis

and upward over the left costal arch This exposed the posterior wall of the stomach the greater curvature being drawn into the mass

7 Transection of the stomach was performed at the junction of the lower two thirds with the upper third The specimen was removed

8 Gastrojejunostomy Polya type was then performed

9 The two invaginated ends of the remaining colon were mobilized and brought together as a closed double barrel colostomy through a small incision to the left of the main mid line incision and the latter was closed in layers

The surgical specimen consisted of most of the transverse colon bearing a large tumor mass, the lower two thirds of the stomach, the spleen, the body and tail of the pancreas, and the omentum (Fig. 57). The total weight was 1,864 gm.

Microscopic study of the tumor revealed adenocarcinoma with infiltration into the stomach and onto the pancreas and regional lymph node metastases.



Fig. 57.—Case 20 (274498). Posterior view of surgical specimen weighing 1,864 gm., consisting of *T*, massive carcinoma of right half of transverse colon; *C′*, splenic flexure; *C″*, hepatic flexure (entire transverse colon resected); *O*, omentum; *P*, body and tail of pancreas; *S*, lower two-thirds of stomach. The latter was infiltrated by carcinoma. At termination of operation, upper ascending and upper descending segments of colon were brought together in mid line incision as double-barrel colostomy. Patient survived 3½ months, died of carcinomatosis but had no pain or obstruction of bowel.

Convalescence was essentially uneventful until the thirty-second day, when a large abscess in the abdominal wall about the colostomy was drained. The patient was discharged on the fifty-seventh day with colostomy functioning normally.

At home the patient spent much time in bed but was also able to be up several hours a day. Asthenia was progressive and appetite was always poor. However, there was no evidence of bowel obstruction and no pain

The patient died at home the middle of March, 1942, 3½ months after operation. Several days prior to death icterus developed which became progressively worse.

The following is an example of more extensive local spread with a more fortunate result following massive excision.

Case 5.—J. C. (283119), white male, 66 years of age. Admitted to the hospital on June 23, 1942, complaining of weakness, sense of weight in the abdomen, loss of 20 pounds weight during the previous year. In the preceding 6 weeks he had noted a small amount of blood in the stools on several occasions. Physical examination revealed a thin subject apparently of stated age. There was a large oval mass in the upper abdomen, the lower border of which was at the umbilicus. The latter was puckered and felt much firmer than normal when the finger was inserted into it. No ascites. The liver was not palpable. Blood pressure 136/74. R.B.C. 4,800,000. W.B.C. 17,000. Wassermann and Kahn negative. Barium enema fluoroscopy showed a filling defect 7 cm. long in the mid portion of the transverse colon. Diagnosis: Carcinoma of the transverse colon. Operation on June 25, 1942, with continuous spinal anesthesia.

HEMICOLECTOMY, PARTIAL GASTRECTOMY, RESECTION OF PERIUMBILICAL REGION OF ABDOMINAL WALL (FIG. 58)

1. A high mid line incision was made and the peritoneal cavity was opened. It became immediately apparent that the mass in the transverse colon was much larger than expected. It was obviously a carcinoma that had extended upward and backward in the gastrocolic ligament to invade the greater curvature of the stomach, and it extended forward and downward in the falciform ligament, reaching the deeper portions of the umbilicus. Palpation of the liver failed to reveal metastases. There was no gross evidence of peritoneal spread or gravitational metastases in the pelvis. In order to encompass the umbilical spread, an elliptical incision in the skin about 4 cm. to each side of the umbilicus was made and joined to the mid line incision. The latter was extended downward for 5 or 6 cm. below the lower border of the umbilical incision.

2. It then became obvious that to resect the tumor and its extensions the lower half of the stomach, most of the transverse colon, the ascending colon and cecum, and the periumbilical region of the abdominal wall would have to be removed en masse. Accordingly, the pylorus was transected and the duodenum invaginated. The stomach was transected in the mid portion. Following this step, the lower half of the stomach adherent to the colon carcinoma was mobilized.

3. The ileum was transected 10 cm. above the ileocecal valve, and the cecum, ascending colon and hepatic flexure were mobilized by division of the lateral leaf of the mesentery and the hepatocolic ligament.

The transverse colon was transected about 6 cm to the left of the gross limits of the neoplasm

4 Resection of the cecum the ascending colon two thirds of the transverse colon bearing the tumor the lower half of the stomach and the periumbilical portion of the anterior abdominal wall (and falciform ligament) en masse was then carried out

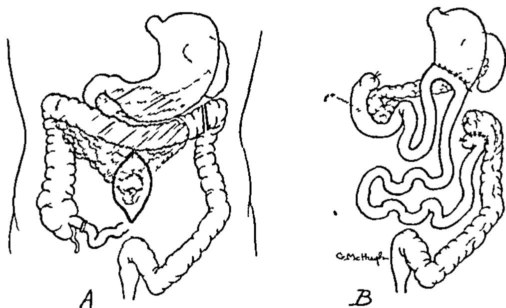


Fig 58 —Case 5 (283119) A schematic representation of massive carcinoma arising in transverse colon and extending backward to involve lower stomach and forward into adbominal wall and producing nodules in umbilicus Elliptical incisions in anterior abdominal wall to encompass extension into abdominal wall B termination of operation after excision of tumor lower half of stomach transverse and ascending colon cecum termination of ileum Ileocolostomy performed (at splenic flexure) Patient alive and well 3 years and 6 months after operation No clinical evidence of carcinoma There were no hepatic metastases observed at operation

5 Ileotransverse colostomy side to side and gastroenterostomy (Polya) terminated the operation

6 Closure of the abdomen was made without drainage

The specimen weighed 1 030 gm and is shown in Figure 59

Histologic study revealed adenocarcinoma of the colon involving the stomach and the regional lymph nodes and extending into the umbilicus

Convalescence was uneventful and the patient was discharged on the eighteenth day after operation Four years and 6 months after operation the patient remains well there is no evidence of recurrence or metastases and he is normally active for an individual his age (70 years) He has maintained a gain of 12 pounds in weight



Fig. 59.—Case 5 (283119). Surgical specimen of operation shown in Figure 58 which includes *T*, invasive carcinoma of transverse colon that has extended forward into abdominal wall, infiltrating the latter and deeper portions of umbilicus; *U*, umbilicus, about which resected portions of abdominal wall have been trimmed away to facilitate photography; *I*, transected ileum; *Co*, ascending colon and appendix; *S*, lower half of stomach infiltrated along greater curvature and posterior wall by carcinoma; *C*, transected splenic flexure. Patient alive, active and well 2½ years after operation. No evidence of recurrent carcinoma.

In wide resections of the transverse colon presenting large carcinomas much or all of the greater omentum must also be resected because of its rich lymphatic network which is readily permeated by carcinoma cells Usually there are extensive adhesions of the omentum about the growth Since the greater omentum is of importance in the localization of infectious processes in the abdomen removal of large segments of it conceivably reduces the resistance of the organism to peritonitis This might well have been an important factor in the fatal outcome of the following patient

Case 66, Rh (193357) white male 56 years of age Admitted to the hospital because of mid epigastric pain loss in weight and roentgenographic evidence of a carcinoma in the mid portion of the transverse colon Laparotomy was performed on May 26 1944 A carcinoma about 8 cm in diameter was encountered in the mid transverse colon The omentum exhibited numerous enlarged firm nodes scattered throughout but especially near the growth There were no liver metastases It was apparent that in order to encompass satisfactorily the growth and its evident metastases resection of the entire transverse colon and entire omentum would be necessary The situation favored this as both the hepatocolic and the splenodiaphragmatic ligaments were redundant These folds of peritoneum were divided The gastrosplenic vessels were divided The base of the transverse mesocolon was divided throughout This permitted exteriorization of practically the entire transverse colon and omentum, and after suitable mobilization the hepatic and splenic flexures were brought together in the mid line This double barrel was directly over the first segment of jejunum beyond the ligament of Treitz The loops of colon were sutured together and the mid line abdominal incision was closed about them Clamps were applied above the skin to the afferent and efferent loops and the exteriorized mass was cut away The latter consisted of the transverse colon bearing the carcinoma, the spleen and the entire omentum (Fig 60) The clamps were removed on the second day and the colostomy began to function The patient s condition appeared satisfactory at first but by the eighth day there was sudden elevation in temperature to 103° F (rectal) and signs of peritonitis He died on the tenth day Necropsy was not permitted The clinical picture however was quite typical for generalized peritonitis At operation there had been no apparent opportunity for soiling of the peritoneal cavity and sulphathiazole had been given



Fig 60.—Case 66 (103357) Surgical specimen composed of entire transverse colon, entire omentum and spleen (*Sp*) resected for carcinoma of mid transverse colon with enlarged firm lymph nodes palpable throughout omentum. Operation terminated by approximation of upper end of ascending and upper end of descending colon to form double-barrel colostomy in mid line incision.

Carcinomas in the region of the splenic flexure may extend into the hilum of the spleen and the distal portions of the body and tail of the pancreas; when large, they also frequently involve segments of upper jejunum. The following are examples of these situations.

Case 2.—C. G. (253198), white female, 49 years of age. Admitted to the hospital on January 4, 1941. Two and a half years previously she had had an attack of acute intestinal obstruction, for which an emergency right sided (cecal) colostomy was performed in another institution. Recovery was satisfactory, and return to normal physical activity was possible, but her existence was rendered very unhappy because of copious movements from the colostomy, not controlled by diet. General physical examination was negative for evidence of carcinoma. A barium enema revealed a typical filling defect of the splenic flexure characteristic of carcinoma.

Operation was performed on January 9, 1941, as follows:

PARTIAL PANCREATOCOLECTOMY WITH SPLENECTOMY

1. A high left rectus incision was made. Palpation revealed a mass in the splenic flexure about the size of a large fist. It was adherent to the anterior parietal peritoneum and to the posterior parietal peritoneum in this region. It was also adherent to the hilum of the spleen and to the tail of the pancreas. There were no apparent hepatic or peritoneal metastases. The lateral peritoneal reflection of the descending colon was incised to mobilize this segment of colon.

2. A circular incision was made about the adhesions of the mass to the anterior parietal peritoneum, freeing the latter with the mass.

3. The right hand was passed over and behind the spleen and downward. By digital dissection the mass was elevated from adhesions to the posterior abdominal wall. The spleen, the mass, and the tail of the pancreas were then elevated. A mass ligature was passed about the distal portion of the body of the pancreas and the splenic vessels 6 cm. proximal to the tip of the tail of the pancreas and proximal to the adhesions to the mass, and the pancreas was transected. During subsequent manipulations the mass was opened. It became apparent that this was a large empty cavity lined by tumor. No colonic wall was identified in this region; instead, the latter appeared to have been replaced by tumor tissue that had extended outward (Fig. 61).

4. The spleen, the tail of the pancreas, and the mass were then exteriorized. The afferent loop to the mass consisted of the left portion of the transverse colon; the efferent loop consisted of the mid portion of the descending colon.

5. Payr clamps were applied to the colon above and below the tumor.



Fig 61 —Case 2" (259325) Surgical specimen consisting of left half of transverse colon, splenic flexure, descending colon and distal portion of body and tail of pancreas *A*, resected for large carcinoma *C* of splenic flexure. The spleen was resected en masse with above but is not shown in photo. The carcinoma had extended through bowel wall completely replacing the latter. *R*, wall composed of thick layer of carcinomatous tissue. *E*, extension of carcinoma into omentum. There was also extension into distal portion of body and tail of pancreas. *D*, descending colon. *B*, left transverse colon.

and the mass was resected Iodoform gauze packs were applied about the closed double barrel colostomy and the remainder of the wound was closed in layers

Convalescence was complicated by a deep left flank and left subdiaphragmatic abscess which was drained The patient was discharged on the thirty fourth day with the wound healed and an open left sided colostomy Bowel movements continued through the right colostomy

Four and one half months later she was readmitted and both colostomies were closed at the same sitting

Following the last discharge the patient s condition appeared quite satisfactory for several months and the absence of colostomies was a source of considerable satisfaction However on February 24 1942 8 months later she was readmitted stating that for the previous week there had been frequent vomiting more or less continuous abdominal pain and extreme weakness She had apparently lost considerable weight Examination revealed no masses or fluid in the abdomen but some resistance in the left upper quadrant Marked asthenia was progressive during the next 4 days and the patient expired on March 1 1942 Necropsy revealed extensive intra abdominal and pulmonary metastases

Another patient (Case 50 [289020] female age 65) presenting a large carcinoma arising in the splenic flexure with direct spread to the lower pole of the spleen the tail of the pancreas and onto a segment of the jejunum was subjected to excision en masse of the growth which necessitated the removal of 17 cm of colon the distal portion of the body and tail of the pancreas the spleen and the segment of the jejunum An abscess was present on the posterior aspect of the carcinoma and this was drained through a stab wound in the left flank A side to side anastomosis of the jejunum was performed and the transected segments of colon were brought through the high left rectus incision as a double barrel colostomy The patient succumbed on the second day postoperative and necropsy revealed general peritonitis

In some instances carcinoma of the splenic flexure exhibits at laparotomy lymphogenous spread toward the liver necessitating a resection much wider than required to encompass the primary neoplasm in the colon itself This situation was encountered in the following case

Case 47 Benz (266972) a white male 42 years old who upon admission to the hospital was found to have hyperthyroidism and roentgenologic evidence of carcinoma of the splenic flexure Thyroidectomy was suc-

cessfully performed after proper preparation with rapid convalescence. Ten days later laparotomy was performed to exposure of a carcinoma about 8 cm in diameter in the splenic flexure. There were obvious metastases in the nodes of the porta hepatis and one large metastasis in the gall bladder near the fundus. Cholecystectomy was performed and several enlarged and firm lymph nodes in the porta hepatis and gastrohepatic omentum were resected. The left half of the transverse colon, including the splenic flexure was then resected and end to end anastomosis between the mobilized upper descending colon and the transected mid portion of the transverse colon was performed with two rows of interrupted sutures. The abdomen was closed with soft rubber drains to the region of the splenic flexure. There were a number of firm enlarged nodes in the upper retroperitoneal spaces about the aorta that were not removed. The patient expired on the tenth day postoperative. Necropsy revealed general peritonitis and the residual carcinomatous lymph nodes described above. Sulphathiazole had been administered in adequate doses during the postoperative period.

Another instance of carcinoma of the splenic flexure with extensive spread but more fortunate outcome following resection is cited below.

Case 38.—L. R. (337950) white male, 39 years of age. Admitted on March 10, 1944 complaining of anorexia and 30 pound weight loss during the previous 6 months, left upper quadrant pain not related to eating or bowel movement 5 months, pain in left upper quadrant on deep inspiration 10 days. Bowel movements were stated to be normal. Four years previously in this clinic he had had a barium fluoroscopy of the colon which was reported as negative. Barium enema fluoroscopy now revealed an obstructing lesion in the region of the splenic flexure. Roentgenograms of the chest were negative. The patient, a large and still apparently well nourished subject, presented no significant findings on clinical examination except for a deep indefinite mass in the left upper quadrant that moved with respiration. The diagnosis of carcinoma of the splenic flexure was made and operation was performed on March 18, 1944 as follows:

PARTIAL GASTRECTO-PANCREATO-COLECTOMY AND SPLENECTOMY (FIGS. 62 AND 63)

1. An oblique incision was made in the upper left quadrant 6 cm. below and parallel to the left costal arch.

2. Palpation and inspection revealed a large rounded mass about 10 cm. in diameter involving the splenic flexure and infiltrating into the posterior gastric wall and onto the peritoneum over the distal portion of the body of the pancreas. There were numerous firm and enlarged lymph nodes in the omentum, much of which was adherent to the inferior surface of the mass. The liver exhibited no visible or palpable metastases.



Fig 62 — Case 38 (332950) Photograph of operation in progress. Surgical specimen is shown in Figures 63 and 64. The pylorus *P* has been divided and is elevated. *St*, stomach; *T*, massive carcinoma of left half of transverse colon; *Sp*, spleen mobilized and exteriorized.

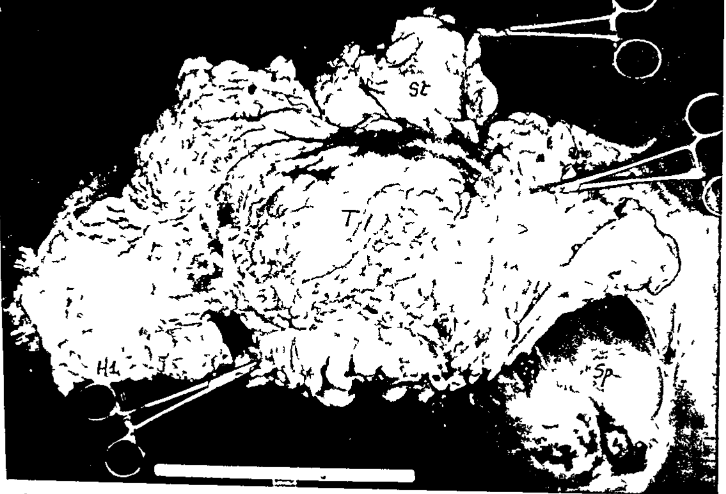


Fig. 63.—Case 38 (839050). Anterior view. Surgical specimen including massive carcinoma *T* involving left half of transverse colon with practically all the omentum adherent to it. *Sp* spleen. *St* lower three-fifths of stomach, the greater curvature of which is infiltrated by carcinoma. The body of the pancreas was also resected because of adherence to tumor but is not visualized in the photograph. Hemostat *H1* is attached to transected lower portion of descending colon. Operation was terminated by Billroth II gastrojejunostomy and double-barreled colostomy composed of hepatic flexure mobilized to left upper quadrant and upper end of sigmoid mobilized to same point. Colostomy closed later. Patient well and in good condition 2 years and 6 months after operation.

3 The pylorus was transected and the distal segment invaginated The greater omentum was divided longitudinally to free that portion arising from the stomach just proximal to the pylorus

4 Two large Payr clamps were applied parallel across the stomach at the junction of the lower three fifths with the upper two fifths and the stomach was transected The upper segment was closed with two layers of continuous sutures The transection was above the majority of gastro splenic vessels Those left intact were divided The lower three fifths of the stomach were now adherent to the tumor mass below

5 The lateral reflection of the peritoneum of the descending colon was divided the splenodiaphragmatic reflections of the peritoneum were also divided The spleen was grasped by the right hand and pulled forward at the same time the tumor mass and the upper descending colon were liberated by gauze dissection from behind Elevation of these structures brought the tail and body of the pancreas forward

6 The body of the pancreas was transected 3 cm distal to the level of the superior mesenteric vessels access to this region being facilitated by the retraction downward of the lower freed portion of the stomach The proximal stump of the pancreas was sewed by several interlocking silk mattress sutures The principal pancreatic duct was not identified The splenic artery and vein were divided and ligated at the level of transection of the body of the pancreas

7 The whole mass consisting of three fifths of the stomach the tumor the left transverse colon the splenic flexure the spleen and most of the body of the pancreas was now attached only by the colon The right portion of the transverse colon was mobilized to permit displacement to the left The whole mass was then brought out through the lower angle of the abdominal wound and held out over the left lower quadrant of the abdomen

8 Short loop gastrojejunostomy (Billroth II) was performed with two rows of continuous suture

9 The base of the left half of the transverse mesocolon was divided The mass was then held upward in the air by an assistant, with the right transverse colon and the lower descending colon attached These efferent and afferent loops were then closely approximated by several interrupted sutures and brought into the lower angle of the wound This necessitated transection of most of the base of the right transverse mesocolon

10 The abdominal wound was closed in layers except for the inferior

angle Two soft rubber drains were placed in the left *upper quadrant* at the excision site Small Payr clamps were applied to the loops of the colon entering and leaving the mass, a few centimeters above the skin and the loops of the colon were transected above them, thus removing the mass by an "obstructive" resection (This left a double barrel colostomy in the upper left quadrant The afferent loop was the extreme right transverse colon and the efferent loop was the lower descending colon)

The surgical specimen weighed 2,500 gm and is shown *in Figures 63* and 64

Convalescence was complicated by a subdiaphragmatic abscess which was drained The patient was discharged on the sixty second day and was fairly active at home He returned to the hospital 5 months later, and the *colostomy was closed The long period between operation and colostomy* closure was due to the slowness in healing of the drainage wound for the subdiaphragmatic abscess It was felt that closure of the colostomy should not be carried out until that wound had healed When the colostomy was closed opportunity was taken to inspect the peritoneal surfaces in the upper abdomen and no evidence of carcinomatosis was observed One year later he returned for repair of incisional hernia and there was op*portunity for inspection of the upper abdomen Again no evidence of* carcinoma was present Convalescence was uneventful Two and a half years after the initial operation he remains well and is back at his usual occupation

Carcinomas arising in the lower descending colon and sigmoid may become attached to and infiltrate the dome of the urinary bladder and in the female may also involve the uterus and adnexae especially on the left side In the following 2 patients not only was there spread to the urinary bladder left lower parietal peritoneum and spermatic cord but also proximally onto a loop of jejunum with metastases to the lymph nodes of the mesentery corresponding to the involved segment of the small bowel in one instance The entire process was resected en masse in each instance

Case 41 —Far (332C61) white male 63 years of age Admitted on May 1 1944 complaining of blood streaked pencil sized stools and rectal tenesmus gradually becoming more pronounced during the preceding 14 years During the previous year there had been increasingly frequent sensations of abdominal distention after meals and during *the pre*ceding 4 weeks more or less constant pain in the left lower quadrant The patient was not aware of decrease in strength appetite or loss of weight during the previous 12 months Physical examination revealed a moderately obese male *of stated age not acutely* ill There was a deep tender elongated mass in the left lower quadrant interpreted to be a

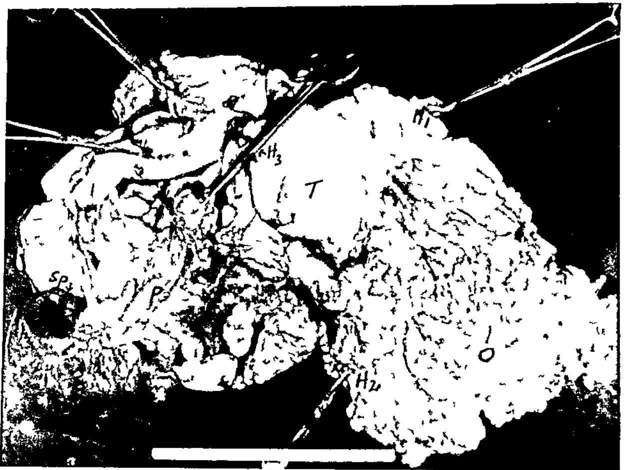


Fig 64—Case 38 (3329 0) 1o terior a pect of surgical pecimen depicted in Figure 63 *O* omentum *T* tumor mass *H_1* hemo tat on right transver e colon *H_2* hemo tat on transecte l lower end of de cen ling colon *Sp* pleen *P* body an l tail of pancreas *H_3* hemo tat on transecte l neck of pancreas lower three-fifths of stomach on upper l ft of photograph Weight of pecimen 2 00 gm

neoplasm of the colon Barium enema revealed a filling defect with moderate obstruction in the lower sigmoid colon

Laparotomy was performed on May 10 1944 as follows

RESECTION OF DESCENDING AND SIGMOID COLONS PARTIAL ENTERECTOMY (JEJUNUM) AND COLOSTOMY (SPLENIC FLEXURE AND UPPER RECTAL COLON)

1 A low left rectus incision was made, which was later extended upward into the left upper quadrant

2 Inspection and palpation of the abdomen revealed a neoplastic mass in the mid sigmoid, about 12 cm in length, adherent to the peritoneum of the left lower anterior abdominal wall on the one hand, and adherent to a loop of the upper ileum, on the other hand There were no visible or palpable liver metastases nor were there firm discrete nodes in the periaortic region There was no evidence of peritoneal spread

3 The entire left lateral leaf of the descending mesocolon was incised The lienocolic ligament was divided The peritoneum and the transversalis fascia about the adhesions of the carcinoma to the lower anterior abdominal wall were incised in elliptical fashion to liberate these tissues with the growth

4 The loop of ileum with its entire mesentery that was invaded by the neoplasm was transected several centimeters on each side of the adhesions and resected Continuity was re established by end to end anastomosis

5 The left transverse colon was then mobilized and brought downward, and the upper rectal colon was mobilized and brought upward It was possible to bring these loops together, and several interrupted sutures were inserted to maintain the approximation

6 The large freed loop consisting of the descending and sigmoid colon the latter including the neoplasm and the adherent peritoneum and parietal fascia and the segment of the jejunum and mesentery were then brought out through the abdominal incision

7 Two large soft-rubber drains were inserted into the left abdominal gutter and brought out through a stab wound to the left of the mid line incision The latter was closed in layers about the afferent and efferent loops of colon, crushing clamps were applied to the latter, and the redundant portions of bowel and tumor were resected (obstructive resection)

Study of the specimen (Fig 65) showed it to consist of 38 cm of de



FIG 65 —Case 41 (332661) Surgical specimen consisting of 38 cm of descending sigmoid and upper rectal colon with *C* carcinoma in latter which has infiltrated outward onto *P* parietal peritoneum and deep fascia of left lower quadrant and upward to involve *I* loop of upper ileum a 10-cm segment of which has been resected with the tumor as shown A segment of mesentery removed with the ileum has been cut away and is not shown in the photograph

scending sigmoid and rectal colon The elongated carcinoma 12 cm in length, was ulcerated only in the lower portion and in this region there was adherence to the segment of parietal peritoneum and transversalis fascia On the opposite aspect of the lesion there was a segment of ileum 10 cm in length adherent to it Probing revealed a small fistula between the colon and the ileal segment, resulting from invasion of the latter by the primary carcinoma of the colon The mesentery of the resected ileum contained no gross evidence of metastases

Microscopic study revealed adenocarcinoma of the colon and sections of several lymph nodes showed no evidence of metastases The colostomy was subsequently closed and 2 years and 4 months after excision the patient remains well with no evidence of recurrences

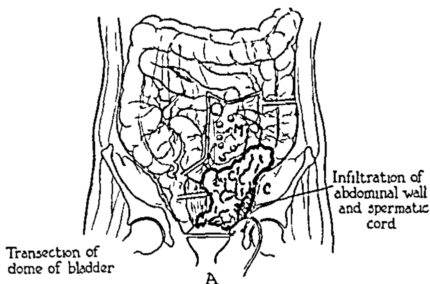
Case 9 —P H (319547) male 49 years old Admitted on October 26 1943 because of diarrhea of 5 months duration There were 4–8 watery stools a day There was usually flatus then the liquid stool He had lost 15 pounds in weight Examination of the abdomen revealed a sausage shaped mass in the left lower quadrant Barium enema fluoroscopy revealed an elongated filling defect in the sigmoid colon with a rather wide diverticulum from the center of the filling defect and directed toward the umbilicus The clinical diagnosis of carcinoma or diverticulitus was made and laparotomy was performed as follows

PARTIAL CYSTOENTEROCOLECTOMY WITH RESECTION OF SEGMENT OF PARIETAL PERITONEUM COLOSTOMY (FIG 66)

1 A low mid line incision was made extending upward several centimeters above the umbilicus

2 An elongated carcinomatous mass was found in the lower sigmoid adherent to the anterior parietal peritoneum and the left spermatic cord in the left lower quadrant and to the dome of the urinary bladder below Above it was adherent to a loop of upper ileum over an area 4 cm in length The serosa of the ileum about the adhesion was markedly injected and the bowel wall was firm and contracted In the mesentery of the small bowel corresponding to the adherent segment, there were several large metastatic lymph nodes these extended upward to near the main trunk of the superior mesenteric artery Inspection and palpation of the liver revealed no metastases and there was no peritoneal spread

3 The left lateral leaf of the peritoneum forming the sigmoid mesentery was divided thus permitting some mobilization of the cancerous bowel The latter was elevated medialward and was found to be adherent to the spermatic cord this was transected on each side of the adhesion The ureter was identified and reflected backward A circular incision was



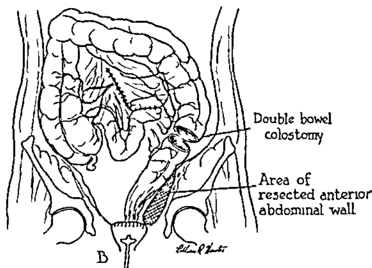


Fig 66 — Case 9 (319547) *A* large carcinoma of sigmoid *C* infiltrating abdominal wall urinary bladder Loop of ileum with ileocolic fistula and metastases in *M* nodes of mesentery of involved segment of small bowel *B* termination of resection by excision en masse of sigmoid abdominal wall in left lower quadrant dome of urinary bladder loop of involved ileum and mesentery with nodes Side-to-side anastomosis of ileum and double barrel colostomy Latter closed 6 weeks later Patient well and at work 8 months later gained 25 pounds in weight

also made to free the anterior parietal peritoneum and the deep fascia over an area 8 cm in diameter, about adhesions of the tumor in the lower quadrant

4 A circular incision was made through the dome of the bladder to permit freeing that portion invaded by tumor Closure of the bladder was made by two rows of interrupted sutures

5 The mesentery of the ileum was incised above the uppermost palpable *metastatic nodule, and the incisions* were carried downward in divergent directions to the involved ileum itself in such a manner as to include all metastatic nodes in the portion to be excised The mesenteric incisions reached the ileum some distance on each side of the segment adherent to the colon carcinoma, and at these points the ileum was transected *the ends invaginated and continuity re established by side to* side anastomosis and closure of the mesentery defect

6 The loop of sigmoid bearing carcinoma and adherent structures was brought out of the abdomen through the incision its mesentery cut to permit greater exteriorization of the afferent loop, the abdominal incision *closed about it clamps applied to the efferent and afferent loops* and the neoplasm and other structures cut away above the clamps A retention catheter was placed in the bladder

The surgical specimen (Fig 67) consisted of a segment of the sigmoid colon with an elongated carcinoma 12 cm in length, adherent to which *on the lower sides were a segment of spermatic cord* a patch of parietal peritoneum and the dome of the urinary bladder measuring 4 cm in diameter Adherent to the upper margin of the carcinoma was *a loop of* ileum 18 cm in length and its corresponding mesentery which included several enlarged metastatic lymph nodes Upon incision of the carcinoma an ileocolic fistula was exposed

The patient s convalescence was uneventful The retention catheter in the bladder *was removed on the tenth day The colostomy* was closed on a subsequent admission 8 weeks later Eight months after operation he was well and back at work as a truck driver having gained *25 pounds in* weight A year after operation pain recurred and 4 months later he died of carcinomatosis

Carcinomas of the sigmoid may extend into the abdominal wall of the left lower quadrant with abscess formation Figure 68 shows the surgical specimen from Case *79 (297424) subjected* to laparotomy because of a large palpable mass in the left lower quadrant associated with roentgeno



Fig 67 —Case 9 (319547) Surgical specimen obtained from operation shown in Figure 66 consisting of (S-R sigmoid and upper rectal colon with massive fungating carcinoma C The latter extended onto D dome of urinary bladder and infiltrated a loop of upper ileum with production T of secondary fungating tumor mass in this segment of bowel and F ileocolic fistula M metastatic nodes in mesentery of secondarily involved ileum L large metastatic node situated over main trunk of superior mesenteric artery Left spermatic cord and parietal peritoneum and deep fascia from abdominal wall in left lower quadrant also resected en masse with above but not shown in photograph

graphic evidence of neoplasm of the colon Because the mass extended into the parietal musculature incisions to encompass it necessitated resection of the abdominal wall en masse, with a redundant loop of the sigmoid and termination of the procedure with a double barrel colostomy When the specimen was opened the mass within the musculature was found to be an abscess communicating directly with a carcinomatous mass in the sigmoid (Fig 68) Such extensions should not preclude excision even though portions of the abdominal wall must also be removed The latter is quite feasible as is evidenced by the cases described above

Following exteriorization of a carcinoma of the colon by the so called 'Mikulicz procedure,' implantation of malignant cells into the abdominal wall may occur and later develop into sizable nodules Resection of such metastases may be performed under certain conditions as in the following patient

Case 84—E R (160578) female 48 years of age Admitted on September 6 1936 complaining of loss of 15 pounds weight during the previous year anorexia and abdominal pain blood streaked stools for a few weeks and marked constipation for 1 week Barium enema revealed a filling defect in the descending colon Examination revealed a large rounded mass in the left portion of the abdomen

Laparotomy was performed on October 7 1936 through a low mid line incision A large rounded mass about 10 cm in diameter was encountered arising from the mid portion of the descending colon and firmly adherent to the left lateral gutter of the posterior abdominal wall A redundant loop of sigmoid below the mass was also adherent to its anterior aspect To facilitate removal another incision in the abdominal wall was made obliquely in the left lower quadrant The parietal peritoneum was incised along the left lateral gutter and the mass together with the colon was elevated toward the mid line The splenic flexure was also mobilized The entire descending colon and the upper portion of the sigmoid were exteriorized in resection of the carcinoma Clamps were applied to the efferent and afferent loops of the colon and the abdominal incisions were closed with double barrel (obstructed) colostomy in the left oblique incision

Study of the surgical specimen revealed that 37 5 cm of colon had been resected and that the neoplasm involved 10 cm of it Sections revealed adenocarcinoma and in 4 mesenteric nodes there were no metastases

Convalescence was uneventful and the patient was discharged on the fifteenth day after operation Her general condition remained satisfactory and the colostomy functioned normally for 2 months At this time a



Fig 68 —Case 79 (297424) Surgical specimen consisting of sigmoid colon with *C* carcinoma penetrating into left lower abdominal wall and *A* abscess formation *M* musculature of abdominal wall about abscess resected en masse with specimen

graphic evidence of neoplasm of the colon Because the mass extended into the parietal musculature, incisions to encompass it necessitated resection of the abdominal wall en masse with a redundant loop of the sigmoid and termination of the procedure with a double barrel colostomy When the specimen was opened the mass within the musculature was found to be an abscess, communicating directly with a carcinomatous mass in the sigmoid (Fig 68) Such extensions should not preclude excision even though portions of the abdominal wall must also be removed The latter is quite feasible as is evidenced by the cases described above

Following exteriorization of a carcinoma of the colon by the so called Mikulicz procedure ' implantation of malignant cells into the abdominal wall may occur and later develop into sizable nodules Resection of such metastases may be performed under certain conditions as in the following patient

Case 34 —E R (160578) female 48 years of age Admitted on September 6 1936 complaining of loss of 15 pounds weight during the previous year anorexia and abdominal pain blood streaked stools for a few weeks and marked constipation for 1 week Barium enema revealed a filling defect in the descending colon Examination revealed a large rounded mass in the left portion of the abdomen

Laparotomy was performed on October 7 1936 through a low mid line incision A large rounded mass about 10 cm in diameter was encountered arising from the mid portion of the descending colon and firmly adherent to the left lateral gutter of the posterior abdominal wall A redundant loop of sigmoid below the mass was also adherent to its anterior aspect To facilitate removal another incision in the abdominal wall was made obliquely in the left lower quadrant The parietal peritoneum was incised along the left lateral gutter and the mass together with the colon was elevated toward the mid line The splenic flexure was also mobilized The entire descending colon and the upper portion of the sigmoid were exteriorized in resection of the carcinoma Clamps were applied to the efferent and afferent loops of the colon and the abdominal incisions were closed with double barrel (obstructed) colostomy in the left oblique incision

Study of the surgical specimen revealed that 37 5 cm of colon had been resected and that the neoplasm involved 10 cm of it Sections revealed adenocarcinoma and in 4 mesenteric nodes there were no metastases

Convalescence was uneventful and the patient was discharged on the fifteenth day after operation Her general condition remained satisfactory and the colostomy functioned normally for 2 months At this time a



Fig 69 —Case (330952) Surgical specimen obtained by combined abdomino perineal resection of carcinoma *Ca* of rectal colon The uterus *ut* was resected en masse because of close adherence to carcinoma There was no gross evidence of actual infiltration of the uterus by carcinoma *Ov* ovary with metastatic neoplasm (Kruckenberg tumor) *Sig* lower sigmoid colon *M* metastatic nodes in mesentery of lower sigmoid removed from anterior aspect of lower portion of abdominal aorta (short sigmoidal mesentery in this patient)

nodule, $3\frac{1}{2}$ cm in diameter was apparent in the abdominal wall just lateral to the colostomy Biopsy of this revealed carcinoma

The patient was readmitted to the hospital and a second operation was performed as follows (December 24 1936)

1 A large elliptical incision, 11×7 cm, was made to include the colostomy and all layers of the abdominal wall When the abdomen was opened numerous firm lymph nodes were encountered in the mesentery of the colostomy and along the greater curvature of the stomach, two loops of small bowel were adherent to a large lymph node in this region The loops of the small bowel were freed by sharp dissection

2 Payr clamps were applied to the afferent and efferent loops of the colon several centimeters from the colostomy and its mesentery with enlarged nodes was isolated by clamps and incisions together with the colostomy and the segment of abdominal wall The latter was then removed, with its adherent structures

3 End to end anastomosis of the colon was made with three rows of interrupted sutures

Following this operation, the patient's condition was satisfactory, but the wound separated with the formation of a fecal fistula Second repair was carried out a month after the above operation but did not afford at this time, permanent closure She was discharged on the fifty sixth day following the first operation By May 1937, the fecal fistula had closed and stools were passed in a normal manner In July, 1937, there was intermittent abdominal pain and occasional vomiting, and by the end of that month a small fistula had again developed in the wound The patient continued to be ambulatory until the early part of September, when her condition began to deteriorate rapidly and she died at home October, 1937 presumably of carcinomatosis

Carcinoma of the lower rectal colon in the female that has extended into the uterus may be excised by the usual combined abdominoperineal resection In liberating the rectal colon, the vesicouterine fold of the peritoneum is incised the bladder reflected forward, and transverse incisions made into the vault of the vagina in order to liberate the uterus adherent to the carcinoma The adnexae are then freed, as in the usual hysterectomy The vagina is closed by two rows of interrupted mattress sutures At the second or posterior stage of the operation the lower segment of the rectal colon with the adherent uterus and adnexae is removed (Fig 69) If the adhesion to the uterus is limited a partial hysterectomy transecting only the adherent fundus may be sufficient



Fig 69 —Case (330252) Surgical specimen obtained by combined abdominoperineal resection of carcinoma (*Ca* of rectal colon The uterus *ut* was resected en masse because of close adherence to carcinoma There was no gross evidence of actual infiltration of the uterus by carcinoma *Ov* ovary with metastatic neoplasm (Kruckenberg tumor) *Sig* lower sigmoid colon *M* metastatic nodes in mesentery of lower sigmoid removed from anterior aspect of lower portion of abdominal aorta (short sigmoidal mesentery in this patient)

Where the carcinoma has developed low in the rectal colon in the female and has infiltrated into the posterior vaginal wall, the abdominal phase of the one-stage combined abdominoperineal operation is performed as usual, at the second perineal stage the patient is placed in the lithotomy position, the anus is closed with a purse string suture and encompassed by elliptical incisions which however, instead of *meeting anterior to the anus* are extended upward and parallel on the posterior vaginal wall to encompass the vaginal extension of the growth which is removed en masse with the lower segment of the colon Following the latter step the edges of the gaping wound in the posterior vaginal wall are approximated by interrupted sutures and the cavity in the lower pelvis is treated in the usual manner Some surgeons pack this cavity with gauze and do not close the wound edges This is done to support the peritoneal diaphragm and obviate a descent of loops of small bowel into the lower pelvis should the diaphragm develop a hiatus The author believes that leaving such a large packed cavity retards convalescence as considerable time is required for it to close He prefers to take special care in suturing the peritoneal diaphragm at the first stage using a continuous suture and reinforcing this with properly spaced interrupted sutures At the second perineal stage relatively small elliptical incisions are made, if possible to encompass the anus and after excision of the rectal colon the cavity in the lower pelvis is obliterated as much as possible by approximation of musculature, one hard rubber tube and two large soft rubber drains are inserted and the skin edges of the perineal wound are closed The hard rubber tube is removed on the third day, and the soft rubber drains on the fifth to seventh days Care is exercised in the subsequent dressings of the posterior wound to obviate as much as possible secondary contamination Such wounds heal more rapidly than those that are left widely open and packed with gauze

Some of the most radical resections described in this chapter with some of the most gratifying results were obtained in patients with carcinomas of the colon that were in the advanced stage by virtue of extension to neighboring tissues and viscera but that did not present hepatic metastases The presence of large localized neoplasms without hepatic metastases indicates resistance to tumor spread on the part of the host or relative slowness on the part of the growth to form distant metastases or both It has long been known that carcinomas of the colon may metastasize to the liver relatively late in their development It thus appears that carcinoma of the colon in advanced stages (locally) affords a fertile field for the extension of operative attack

CHAPTER XI

CARCINOMA OF THE HEAD OF THE PANCREAS

The radical treatment of malignant disease of the pancreas by the surgeon can hardly be said to exist.—Sir Berkeley Moynihan (1926)

CARCINOMA of the head of the pancreas, until a few years ago, was regarded as inoperable because of its location, and biliary short circuiting operations were performed for the relief of the obstructive jaundice which usually accompanied this condition.

Recent experience has shown that the entire head of the pancreas and the duodenum may be resected successfully and that survival is possible with the pancreatic juice occluded (Case 92). Thus small carcinomas of the head of the pancreas are indeed operable lesions, but the relative infrequency of operations for excision of such growths justifies their consideration in this treatise. Also, the operability of these tumors is not yet widely appreciated.

PANCREATODUODENECTOMY

Pancreatoduodenectomy, resection of the head of the pancreas, the lower segment of the stomach, the entire duodenum, and the first few centimeters of the jejunum, may be carried out in one or two stages.

The procedure for the one stage operation follows (Fig. 70):

1. A high mid line, transverse, reverse L, or inverted T incision is made.

2. Incision of the parietal peritoneum is carried out along the convex margin of the second portion of the duodenum. This permits elevation of the duodenum and the head of the pancreas for palpation and inspection of the posterior aspect of the latter and the lower segment of the common duct. It also affords the opportunity to determine whether or not the portal vein is invaded. If it appears that the portal or superior mesenteric veins are not invaded by neoplasm, the operation is carried out.

3. The lower portion of the stomach is transected about 6–8 cm. above the pylorus. Invagination of the upper segment of the stomach is performed, followed by its retraction upward under the left costal arch. The duodenal stump is retracted to the right.

4 Ligation and transection of the superior pancreatoduodenal artery and veins

5 The common bile duct, which is dilated because of obstruction, is transected at the level of the superior margin of the first segment of the duodenum An aspirating cannula is placed in the opened common duct and all bile is aspirated before the transection is completed

6 The attachment of the transverse mesocolon over the head of the pancreas is incised and the colon is retracted downward, care being exercised not to injure the middle colic artery as it arises from the superior mesenteric artery The superior mesenteric vein is identified and the neck of the pancreas is transected at this level

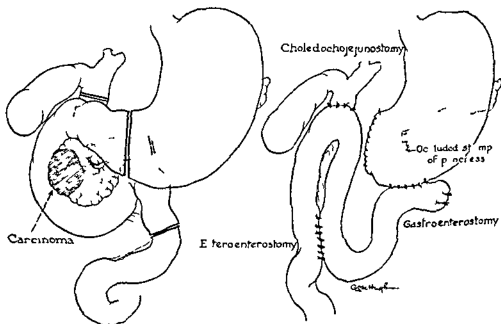
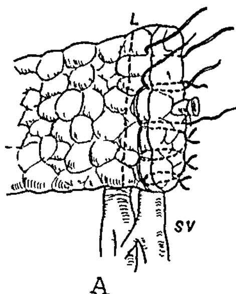


Fig 70 —Diagrammatic representation of author's technique of one-stage pancreatoduodenectomy for carcinoma of head of pancreas (or ampulla) In this operation no attempt is made to reimplant transected stump of pancreas (see text for discussion)

7 In transecting the neck of the pancreas the main pancreatic duct which can readily be identified as it is severed is clamped with a small forceps rotated through 90° and ligated with silk or linen In the incised margins of parenchyma interlocking mattress sutures are inserted to exert firm compression and occlude severed minor ducts (Fig 71) In addition a mass ligature may be placed about the stump of the pancreas

8 The ligament of Treitz is transected to permit mobilization of the duodenojejunal junction By traction upon the third portion of the duo



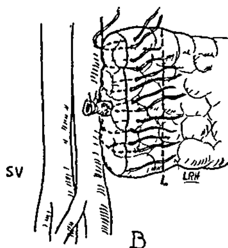


Fig 71 —Diagrammatic representation of methods of closing transected neck of pancreas A body and tail of pancreas resected (see chap xii) main duct ligated rest of stump closed by interlocking mattress sutures *B* Head of pancreas has been resected and stump of body treated in similar manner SV superior mesenteric vessels dotted lines *L* indicate levels at which mass ligatures may be placed about stump of pancreas in addition to mattress sutures

denum, the first few centimeters of the jejunum may be brought to the right under the superior mesenteric vessels and transection of the bowel is carried out 3 or 4 cm distal to the attachment of the ligament of Treitz The uncinate process of the pancreas, closely associated with the superior border of the third portion of the duodenum is also thus brought into the field Transection of the jejunum permits removal en bloc of the head and neck of the pancreas, the lower segment of the stomach the duodenum and the first few centimeters of the jejunum

9 The distal jejunal segment is invaginated and just beyond this a posterior gastrojejunostomy (posterior Billroth II) is performed

10 At a level of about 15 cm distal to this anastomosis a choledochojejunostomy is performed with two rows of interrupted silk sutures

11 Enteroenterostomy between the efferent and the afferent segments of the jejunum (to the choledochojejunostomy) is carried out below the level of the transverse mesocolon

12 The abdomen is closed with a soft rubber drain to the site of the head of the pancreas

Seven patients were subjected to this procedure by the author and the histories and results are summarized below They were all considered 'advanced carcinoma' The patients with small lesions are not included in this essay

Whenever possible a choledochojejunosotmy is performed rather than a cholecystojejunostomy or cholecystgastrostomy because the ligated transected common bile duct has reopened in some instances with fatal peritonitis

The operation as described was originally performed in two stages at 3–4 weeks' interval The first stage consisted of gastroenterostomy and cholecystojejunostomy or cholecystgastrostomy Experience has shown that complications may develop after the first stage with a delay in the second stage or even failure of opportunity for the second stage Further more numerous adhesions resulting from a multiple step first stage operation render the second stage appreciably more difficult Thus in the writer's opinion the operation should be performed in one stage if possible

The following is a summary of 7 patients in whom there was advanced carcinoma of the head of the pancreas (or ampulla which presents the same surgical problem) and who were subjected to one stage pancreatoduodenectomy

Case 10[1]—N. C. (2648) male, 54 years of age. Large fungating carcinoma of ampulla invading the head of the pancreas with metastases to the nodes about the head of the pancreas and a node in the porta hepatis. No hepatic metastases.

Resection with all visible metastases.

Living and well 9½ years after operation.

Case 43—Had. (92541) male, 57 years of age. Carcinoma 5 × 4 × 2.5 cm. replacing the entire head of the pancreas with periaortic lymph node metastases. No hepatic metastases.

Resection. Periaortic nodes left behind.

Lived 5 months and 3 weeks. Relieved of icterus, gained weight for brief period.

Necropsy revealed carcinomatosis.

Case 44—Her. (259.20) male, 35 years of age. Carcinoma 5 × 4 × 3 cm. replacing the head of the pancreas. Deep periaortic metastatic nodes. No hepatic metastases.

Resection. Periaortic nodes not resected (Fig. 71).

Lived 5 months. Relieved of icterus, gained weight for brief period.

Necropsy revealed carcinomatosis.

Case [illegible]—Lasw. (300.80) female, 71 years of age. Large carcinoma in the head of the pancreas ulcerating into the duodenum, direct extension into the transverse mesocolon with infiltration about the middle colic artery.

Resection, dissection of tumor from about the middle colic artery.

Lived 8 days. Died of asthenia (?). Plasma proteins 3.72 gm. per cent.

Necropsy not obtained.

Case 61—Bl. (230018) male, 54 years of age. Large fungating carcinoma of ampulla extending into the head of the pancreas. Lymph node metastases in the nodes about the head of the pancreas, one large metastatic node in the porta hepatis, one metastatic mass in the left lobe of the liver.

Resection, node in porta hepatis excised, hepatic metastasis excised.

Died ninth day. Uremia.

Necropsy revealed no peritonitis or hemorrhage. Anastomoses tight. Kidneys showed acute glomerulonephritis.

Case 74—Ib. (248915) male, 71 years of age. Large carcinoma in the head of the pancreas with extension up the common duct.

Resection.

Lived 3 days. Necropsy revealed bilateral aspiration bronchopneumonia. Carcinoma had extended into the body of the pancreas beyond the level of resection.

Case 77—Wels. (284,0?5) male, 46 years of age. Carcinoma of ampulla extending up common duct for 2.5 cm. above its entrance into the duodenum.

Resection.

Lived 2½ years after operation, returned to work, but finally died of metastases.

Modifications of the above procedure have been described by W[illegible], Trimble and Pearse. These are depicted in Figure 70, and in all of them the external pancreatic secretion is occluded.

Marked debility with icterus may well justify a two stage operation.

[1] Case 10 is described in detail in chap. ix.

denum the first few centimeters of the jejunum may be brought to the right under the superior mesenteric vessels and transection of the bowel is carried out 3 or 4 cm distal to the attachment of the ligament of Treitz The uncinate process of the pancreas closely associated with the superior border of the third portion of the duodenum is also thus brought into the field Transection of the jejunum permits removal en bloc of the head and neck of the pancreas the lower segment of the stomach the duodenum and the first few centimeters of the jejunum

9 The distal jejunal segment is invaginated and just beyond this a posterior gastrojejunostomy (posterior Billroth II) is performed

10 At a level of about 15 cm distal to this anastomosis, a choledochojejunostomy is performed with two rows of interrupted silk sutures

11 Enteroenterostomy between the efferent and the afferent segments of the jejunum (to the choledochojejunostomy) is carried out below the level of the transverse mesocolon

12 The abdomen is closed with a soft rubber drain to the site of the head of the pancreas

Seven patients were subjected to this procedure by the author and the histories and results are summarized below They were all considered "advanced carcinoma The patients with small lesions are not included in this essay

Whenever possible a choledochojejunosotmy is performed rather than a cholecystojejunostomy or cholecystgastrostomy because the ligated transected common bile duct has reopened in some instances with fatal peritonitis

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The following is a summary of 7 patients in whom there was advanced carcinoma of the head of the pancreas (or ampulla which presents the same surgical problem) and who were subjected to one stage pancreatoduodenectomy

Case 10[1]—N C (2018) male 55 years of age Large fungating carcinoma of ampulla invading the head of the pancreas with metastases to the nodes about the head of the pancreas and a node in the porta hepatis No hepatic metastases

Resection with all visible metastases

Living and well 3½ years after operation

Case 42—Flud (12511) male 57 years of age Carcinoma 5 × 4 × 2.5 cm replacing the entire head of the pancreas with periaortic lymph node metastases No hepatic metastases

Resection Periaortic nodes left behind

Lived 5 months and 3 weeks Relieved of icterus gained weight for brief period

Necropsy revealed carcinomatosis

Case 43—Her (280720) male 35 years of age Carcinoma 5 × 4 × 3 cm replacing the head of the pancreas Deep periaortic metastatic nodes No hepatic metastases

Resection Periaortic nodes not resected (Fig 71)

Lived 5 months Relieved of icterus gained weight for brief period

Necropsy revealed carcinomatosis

Case 5—Lasw (306580) female 73 years of age Large carcinoma in the head of the pancreas ulcerating into the duodenum direct extension into the transverse mesocolon with infiltration about the middle colic artery

Resection dissection of tumor from about the middle colic artery

Lived 8 days Died of asthenia ( ) Plasma proteins 3 72 gm per cent

Necropsy not obtained

Case 71—Bl (290018) male 54 years of age Large fungating carcinoma of ampulla extending into the head of the pancreas lymph node metastases in the nodes about the head of the pancreas one large metastatic node in the porta hepatis one metastatic mass in the left lobe of the liver

Resection node in porta hepatis excised hepatic metastasis excised

Died ninth day Uremia

Necropsy revealed no peritonitis or hemorrhage Anastomoses tight Kidneys showed acute glomerulonephritis

Case 74—Th (24881) male 71 years of age Large carcinoma in the head of the pancreas with extension up the common duct

Resection

Lived 3 days Necropsy revealed bilateral aspiration bronchopneumonia Carcinoma had extended into the body of the pancreas beyond the level of resection

Case 77—Web (287(25) male 46 years of age Carcinoma of ampulla extending up common duct for 2 5 cm above its entrance into the duodenum

Resection

Lived 2½ years after operation returned to work but finally died of metastases

Modifications of the above procedure have been described by Whipple Trimble and Pearse These are depicted in Figure 70 and in all of them the external pancreatic secretion is occluded

Marked debility with icterus may well justify a two stage operation In

[1] Case 10 is described in detail in chap ix

denum the first few centimeters of the jejunum may be brought to the right under the superior mesenteric vessels and transection of the bowel is carried out 3 or 4 cm distal to the attachment of the ligament of Treitz The uncinate process of the pancreas closely associated with the superior border of the third portion of the duodenum is also thus brought into the field Transection of the jejunum permits removal en bloc of the head and neck of the pancreas the lower segment of the stomach the duodenum and the first few centimeters of the jejunum

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11 Enteroenterostomy between the efferent and the afferent segments of the jejunum (to the choledochojejunostomy) is carried out below the level of the transverse mesocolon

12 The abdomen is closed with a soft-rubber drain to the site of the head of the pancreas

Seven patients were subjected to this procedure by the author and the histories and results are summarized below They were all considered 'advanced carcinoma' The patients with small lesions are not included in this essay

Whenever possible a choledochojejunosotmy is performed rather than a cholecystojejunostomy or cholecystgastrostomy because the ligated transected common bile duct has reopened in some instances with fatal peritonitis

The operation as described was originally performed in two stages at 3–4 weeks interval The first stage consisted of gastroenterostomy and cholecystojejunostomy or cholecystgastrostomy Experience has shown that complications may develop after the first stage with a delay in the second stage or even failure of opportunity for the second stage Further more numerous adhesions resulting from a multiple step first stage operation render the second stage appreciably more difficult Thus in the writer s opinion the operation should be performed in one stage if possible

The following is a summary of 7 patients in whom there was advanced carcinoma of the head of the pancreas (or ampulla which presents the same surgical problem) and who were subjected to one stage pancreatoduodenectomy

Case 10[1]—N C (2648) male [illegible] years of age Large fungating carcinoma of ampulla invading the head of the pancreas with metastases to the nodes about the head of the pancreas and a node in the porta hepatis No hepatic metastases

Resection with all visible metastases

Living and well 3½ years after operation

Case 43—Had (92,44) male 57 years of age Carcinoma [illegible] × 4 × [illegible] cm replacing the entire head of the pancreas with periaortic lymph node metastases No hepatic metastases

Resection Periaortic nodes left behind

Lived [illegible] months and 3 weeks Relieved of icterus gained weight for brief period

Necropsy revealed carcinomatosis

Case 44—Her (289,20) male [illegible] years of age Carcinoma [illegible] × 4 × 3 cm replacing the head of the pancrea Deep periaortic metastatic nodes No hepatic metastases

Resection Periaortic nodes not resected (Fig 71)

Lived [illegible] months Relieved of icterus gained weight for brief period

Necropsy revealed carcinomatosis

Case [illegible]—Lasw (306,580) female [illegible] years of age Large carcinoma in the head of the pancreas ulcerating into the duodenum direct extension into the transverse mesocolon with infiltration about the middle colic artery

Resection dissection of tumor from about the middle colic artery

Lived 8 days Died of asthenia ( ) Plasma proteins 3 [illegible] gm per cent

Necropsy not obtained

Case 61—Bl (290018) male [illegible] years of age Large fungating carcinoma of ampulla extending into the head of the pancreas lymph node metastases in the nodes about the head of the pancrea one large metastatic node in the porta hepatis one metastatic mass in the left lobe of the liver

Resection node in porta hepatis excised hepatic metastasis excised

Died ninth day Uremia

Necropsy revealed no peritonitis or hemorrhage Anastomoses tight Kidneys showed acute glomerulonephritis

Case [illegible]—Th (248815) male 71 years of age Large carcinoma in the head of the pancreas with extension up the common duct

Resection

Lived 3 days Necropsy revealed bilateral aspiration bronchopneumonia Carcinoma had extended into the body of the pancreas beyond the level of resection

Case [illegible]—Web (28 [illegible]) male 40 years of age Carcinoma of ampulla extending up common duct for 2 5 cm above its entrance into the duodenum

Resection

Lived 2½ years after operation returned to work but finally died of metastases

Modifications of the above procedure have been described by Whipple Trimble and Pearse These are depicted in Figure 70 and in all of them the external pancreatic secretion is occluded

Marked debility with icterus may well justify a two stage operation In

[1] Case 10 is described in detail in chap IX

denum, the first few centimeters of the jejunum may be brought to the right under the superior mesenteric vessels and transection of the bowel is carried out 3 or 4 cm distal to the attachment of the ligament of Treitz The uncinate process of the pancreas closely associated with the superior border of the third portion of the duodenum, is also thus brought into the field Transection of the jejunum permits removal en bloc of the head and neck of the pancreas the lower segment of the stomach the duodenum and the first few centimeters of the jejunum

9 The distal jejunal segment is invaginated and just beyond this a posterior gastrojejunostomy (posterior Billroth II) is performed

10 At a level of about 15 cm distal to this anastomosis, a choledocho jejunostomy is performed, with two rows of interrupted silk sutures

11 Enteroenterostomy between the efferent and the afferent segments of the jejunum (to the choledochojejunostomy) is carried out below the level of the transverse mesocolon

12 The abdomen is closed with a soft rubber drain to the site of the head of the pancreas

Seven patients were subjected to this procedure by the author and the histories and results are summarized below They were all considered "advanced carcinoma The patients with small lesions are not included in this essay

Whenever possible a choledochojejunosotmy is performed rather than a cholecystojejunostomy or cholecystgastrostomy because the ligated transected common bile duct has reopened in some instances with fatal peritonitis

The operation as described was originally performed in two stages at 3–4 weeks' interval The first stage consisted of gastroenterostomy and cholecystojejunostomy or cholecystgastrostomy Experience has shown that complications may develop after the first stage with a delay in the second stage or even failure of opportunity for the second stage Further more numerous adhesions resulting from a multiple step first stage operation render the second stage appreciably more difficult Thus in the writer's opinion the operation should be performed in one stage if possible

The following is a summary of 7 patients in whom there was advanced carcinoma of the head of the pancreas (or ampulla which presents the same surgical problem) and who were subjected to one stage pancreato duodenectomy

Case 10[1]—N G (2018) male 55 years of age Large fungating carcinoma of ampulla invading the head of the pancreas with metastases to the nodes about the head of the pancreas and a node in the porta hepatis No hepatic metastases

Resection with all visible metastases

Living and well 9½ years after operation

Case 33—Flod (32544) male 57 years of age Carcinoma 5 × 4 × 2.5 cm replacing the entire head of the pancreas with periaortic lymph node metastases No hepatic metastases

Resection Periaortic nodes left behind

Lived 5 months and 3 weeks Relieved of icterus gained weight for brief period

Necropsy revealed carcinomatosis

Case 34—Her (287 20) male 55 years of age Carcinoma 5 × 4 × 3 cm replacing the head of the pancreas Deep periaortic metastatic nodes No hepatic metastases

Resection Periaortic nodes not resected (Fig 71)

Lived 5 months Relieved of icterus gained weight for brief period

Necropsy revealed carcinomatosis

Case —Lasw (306580) female 73 years of age Large carcinoma in the head of the pancreas ulcerating into the duodenum direct extension into the transverse mesocolon with infiltration about the middle colic artery

Resection dissection of tumor from about the middle colic artery

Lived 8 days Died of asthenia ( ) Plasma protein 3 79 gm per cent

Necropsy not obtained

Case 61—Bl (290018) male 54 years of age Large fungating carcinoma of ampulla extending into the head of the pancreas lymph node metastases in the nodes about the head of the pancreas one large metastatic node in the porta hepatis one metastatic mass in the left lobe of the liver

Resection node in porta hepatis excised hepatic metastasis excised

Died ninth day Uremia

Necropsy revealed no peritonitis or hemorrhage Anastomoses tight Kidneys showed acute glomerulonephritis

Case —Th (248815) male 71 years of age Large carcinoma in the head of the pancreas with extension up the common duct

Resection

Lived 3 days Necropsy revealed bilateral aspiration bronchopneumonia Carcinoma had extended into the body of the pancreas beyond the level of resection

Case —Web (287125) male 40 years of age Carcinoma of ampulla extending up common duct for 2.5 cm above its entrance into the duodenum

Resection

Lived 2½ years after operation returned to work but finally died of metastases

Modifications of the above procedure have been described by Whipple Trimble and Pearse These are depicted in Figure 70 and in all of them the external pancreatic secretion is occluded

Marked debility with icterus may well justify a two stage operation In

[1] Case 10 is described in detail in chap ix

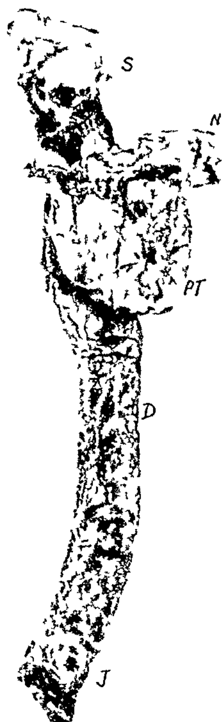


Fig. 53. Case 11 (289720) Surgical specimen of one-stage pancreatoduodenectomy for large carcinoma in head of pancreas. *PT*, *N*, neck of pancreas. *S*, lower portion of pylorus. *D*, duodenum. *J*, 3 cm of jejunum. Patient succumbed of carcinomatosis 5 months after operation. However there was relief from jaundice and pain and patient was active for about 4 months after operation but had recurrences after 5 months.

this event a cholecystojejunostomy or preferably choledochojejunostomy, after transection of the common bile duct with ligation of the lower segment at the level described above would be sufficient to relieve the icterus. This constitutes a minimal type of operation, thus sparing the patient and lessening the number of adhesions prior to the second stage.

The problem of prolonged survival in adequate nutrition without external pancreatic secretion is not as yet finally elucidated. Following resection of the head of the pancreas and the duodenum one of three situations may obtain: (1) there may be normal stools; (2) the stools may be bulky, pale, foul, pasty, but not abnormally frequent (once or twice a day), or (3) there may be frank steatorrhea. The reason for these differences is not apparent and there are no means at present to predict in which manner the patient will react following operation. Since it has been demonstrated that aberrant pancreatic tissue frequently may be present in the stomach, in the extrahepatic biliary passages, or in the small bowel and thus afford extrapancreatic sources for pancreatic juice, it is possible that such anomalies are present in those patients who show little alteration in the stools following occlusion of pancreatic secretion resulting from pancreatoduodenectomy.

In three patients following one-stage pancreatoduodenectomy studies were carried out to determine whether or not significant changes in their physiologic economy could be detected to indicate that indefinite survival was not possible with the entire duodenum and the head of the pancreas excised. The results are summarized in Table 10. Protein metabolism was not disturbed. Fat absorption was impaired in Cases Had. and Her. In the former pancreatin increased the absorption from 8.8 to 35 per cent.

Patient Web., referred to in the table, was alive, well, and doing heavy physical work 2 years after operation, having gained 25 pounds in weight. One year and a half after operation he exhibited mild diabetes. This is regarded as a coincidental disease and not related to the operation.

In addition to the studies reported in the table, raw ground meat was fed, 2 pounds in a 24 hour period, and subsequently the stools were inspected for raw meat fibers. These were present in small quantities in the stools of patients Had. and Her. and not present in the stools of patient Web.

Studies in fat absorption similar to those mentioned above in Table 10

[2] A second patient (Case 10 (2613)) has had complete occlusion of pancreatic juice for 3½ years, is back at work and also presents no physiologic disturbances incident to the occlusion.

TABLE 10

Studies in 3 Patients with One-Stage Pancreatoduodenectomy (Excision of Entire Duodenum and Head of Pancreas) thus Occluding Pancreatic Secretion

Patient	Plasma Proteins (Gm %)		N.P.N. (Mg %)		Fasting Dextrose (Mg %)		Blood Amylase (Somogyi Units)	
	Preop	Postop	Preop	Postop	Preop	Postop	Preop	Postop
Flad	6.57	6.18 (14 weeks)	20	18.6 (14 weeks)	111	92 (6 days)		31 (14 weeks)
Her	6.34	6.06 (12 weeks)	16	23 (4 weeks)	81	65 (12 weeks)	45	21 (8 weeks)
Web	6.25	6.00 (13 weeks)	32	30 (13 weeks)		88 (13 weeks)	200	105 (12 weeks)

FAT ABSORPTION

Patient	Time (Postop Weeks)	Fat Intake		Fat in Stools (Gm.)	Percentage Fat Absorbed	Gross Appearance of Stool
		(Gm.	Days)			
Flad	14	280 219 (+pancreatin)	5 3	248 142	8.8 35	Light yellow pasty bulky
Her	5	344	8	330	4	Light yellow pasty bulky
Web	12	450	8	37	91.[illegible]	Normal (formed and dark brown)

BLOOD LIPIDS AND CHOLESTEROL

Patient	Time (Postop Weeks)	Total Lipid (Mg %)	Total Cholesterol (Mg %)	Free Cholesterol (Mg %)
Flad	11	963	137.7	93.6
	16	630	42.4	27
	20	573	100	82.4
Her	3	1066	151.5	217.2
	6	577	34.5	98
	18	633	92.5	60
Web	7	576	84	49.4
	35	783	92	73.5

have been reported by Whipple and Bauman They observed 97 per cent fat absorption in 2 patients from whom part of the duodenum and part of the head of the pancreas had been resected but in one instance there was considerable variation i e 33 98 per cent from day to day In a third patient in whom the entire duodenum and the head of the pancreas had been removed fat absorption varied daily from 0 to 92 per cent

Two of the patients referred to above (Had and Her) died of carcinomatosis 5½ and 5 months respectively after operation Necropsy revealed no evidence of duct proliferation from the transected neck of the

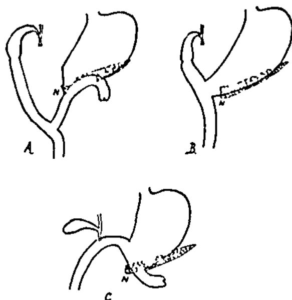


Fig 75 — Schematic representation of pancreatoduodenectomy as suggested (A) by Whipple 1940) (B) by Pearse (1942) (C) by Trimble (1941) In all instances neck of pancreas N is occluded thus suppressing external pancreatic secretion

pancreas to the jejunal wall This is contrary to experiences in the dog in which duct proliferation from transected portions of the pancreas readily occurs and renders difficult the permanent occlusion of pancreatic secretion from the bowel

It thus appears as stated above that occlusion of pancreatic secretion in man is not incompatible with prolonged survival in normal condition in at least *some* patients In others faulty absorption of fat occurs with characteristic fatty stools Even in such patients the quantity of fat absorbed may be sufficient for nutritional requirements In those patients with frank steatorrhea and fat absorption below that required for normal nutrition pancreatin has been administered with varying success

Since normally, pancreatic secretion is poured into the duodenum restitution of this secretion into the upper jejunum would appear to be desirable Recent publications have described procedures for *reimplanting* in man the transected neck of the pancreas or the isolated pancreatic duct into the jejunum following excision of the head of the pancreas and the

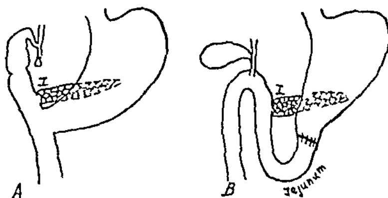


FIG 74 —Schematic representation of pancreatoduodenectomy with reimplantation of transected neck of pancreas *I* into jejunum *A* as suggested by Whipple (1943) *B* by Cattel (1944) Poth (1944) used small metal cannula in main pancreatic duct in perfecting operation as depicted in *A*

entire duodenum (Fig 74 [Cattell Whipple Poth]) Experiences with these procedures are too recent to permit of the final assumption that the flow of pancreatic juice is thus re established and such conclusions must await necropsy confirmation of patent duct systems present after appreciable periods following operation The successful anatomic implantation at operation does not assure the subsequent absence of occluding stenosis of the duct The evidence afforded by the enzymic content of gastric aspiration obtained while such patients are alive is equivocal

CHAPTER VII

OPERATIONS FOR CANCER OF THE BODY OF THE PANCREAS

TOTAL PANCREATECTOMY

SINCE the body and tail of the pancreas are relatively removed from the alimentary canal, neoplasms arising in them are rarely encountered early in development, as biliary tract or bowel obstruction are not present at this stage. The large majority of such patients receive exploratory laparotomy after metastases have developed or after local spread precludes complete excision of the neoplasm.

Experience with benign neoplasms of the pancreas and with hyperinsulinism not associated with islet-cell tumor has shown that excision of the body and tail of this organ is readily performed and does not entail undue risks of pancreatitis. As a palliative measure to relieve pain, resection of the cancerous body of the pancreas may be performed where metastases are not too extensive, or if the metastases are extensive and pain has been very severe, excision of the body may be performed as a measure to relieve pain.

The following is an example:

Case [illegible]*.*—M. K. ([illegible]), white male, [illegible] years of age. Admitted to the hospital complaining of constant epigastric pain with high girdle radiation of [illegible] months' duration and loss of 13 pounds weight. The pain was not related to ingestion of food or bowel movements. It was regularly worse at night or when the patient lay down. Narcotics were given at frequent intervals for amelioration of the discomfort. Roentgenographic study of the stomach, duodenum, and colon was negative. The clinical diagnosis of carcinoma of the body of the pancreas was made, and laparotomy was performed.

RESECTION OF BODY OF PANCREAS—SPLENECTOMY, MORRIS-TALMA OMENTOPEXY

1. A high transverse incision was made. A firm tumor mass was palpated in the body of the pancreas involving most of this portion of the gland, and there were numerous scattered metastatic nodules in the liver.

2. Transection of the gastrocolic omentum below the epiploic vessels was carried out. Care was exercised to avoid injury to the middle colic artery, since the layers of the gastrocolic omentum and the transverse mesocolon were closely applied.

3 The stomach was retracted upward and the transverse colon downward to expose the body of the pancreas which was extensively involved by carcinoma The gastrosplenic vessels were ligated and divided

4 The spleen was grasped with the right hand mobilized, and brought forward, this elevated the tail and the distal portion of the body of the pancreas

5 A ligature (linen) was passed about the whole thickness of the pancreas at the level of the superior mesenteric vessels to include the splenic artery and vein and was tied firmly Transection of the pancreas was made just distal to the ligature After transection of the pancreas the spleen and the body of the pancreas (bearing the tumor) were removed (Additional mattress sutures may be placed in the proximal stump of the pancreas although a single mass ligature is sufficient)

6 Closure of the abdominal wound was made with a soft rubber drain to the ligated stump of the pancreas A Morris Talma omentopexy was performed

(In some instances the tail and body of the pancreas will be found sufficiently dissociated from the spleen and the splenic vessels to permit of resection without removal of the spleen or ligation of the splenic vein and artery)

Study of the surgical specimen revealed that the carcinomatous body of the pancreas weighed 120 gm A small portion of the tail distal to the tumor appeared pale and atrophic The spleen weighed 272 gm and appeared normal Histologic examination revealed the neoplasm to be a typical duct cell carcinoma and the portion of the pancreas distal to the tumor contained no acinar tissue and was composed of agglomerated islets in fibrous tissue—a typical reaction of the pancreas when the main duct is occluded

Convalescence was essentially uneventful from the standpoint of postoperative complications There was considerable relief from the constant epigastric pain The patient arose on the fourteenth day but was very weak Thereafter asthenia was progressive and the patient finally became icteric on the thirtieth postoperative day He died 6 days later Necropsy revealed carcinomatosis It was the distinct impression that the operation afforded this patient considerable palliation in that the severe epigastric pain was almost completely relieved

Another instance of similar but brief palliation was afforded in the following patient

Case 29.—Mag (60813) male 40 years of age There had been a previous luetic infection for which considerable treatment had been received Irregular attacks of pain were experienced in the left upper quadrant lasting a few moments at first and finally becoming severe enough to "double him up" of 3 months duration In addition costovertebral pain developed and there were very painful areas over the lower lateral aspects of the thorax described as if he were "seized by large ice tongs" There were nausea and vomiting at irregular intervals General laboratory studies were negative Barium fluoroscopy of the stomach and colon were also negative Because of the nature and persistence of the pain a clinical diagnosis of carcinoma of the body of the pancreas was made and exploratory laparotomy was advised

RESECTION OF BODY AND TAIL OF PANCREAS AND SPLEEN—MORRIS TALMA OMENTOPEXY

Operation was performed on October 11 1943 and a hard tumor mass 9 × 4 × 2 5 cm obviously malignant was discovered arising from the superior margin of the mid portion of the body of the pancreas The liver was cirrhotic but palpation and inspection revealed no evidences of metastases There were no apparent metastases elsewhere The pancreas was exposed between the stomach and the transverse colon the neck was transected and its proximal stump ligated Traction upon the body of the pancreas permitted mobilization of the tumor mass from the anterior aspect of the aorta The splenic artery and vein were ligated at the level of the neck of the pancreas The tumor mass with the body and tail of the pancreas was excised with the spleen after transection of the neck and ligation of the proximal stump Because of the cirrhotic process in the liver a biopsy of this organ was performed Two large soft rubber drains were placed at the excision site Incisions were made through the parietal peritoneum and the posterior rectus sheaths on each side of the mid line incision and the omentum was brought through them and sutured to the posterior aspects of each rectus muscle (Morris Talma operation) The abdominal incision was then closed The surgical specimen is shown in Figure 75

Histologic sections of the tumor showed it to be an adenocarcinoma The cirrhosis of the liver was in an active stage as revealed by the relatively large numbers of polymorphs and lymphocytes in the wide interlobular septa

Following operation there was relief from the severe "tonglike" pains previously experienced Convalescence was uneventful except for a slowly progressive icterus The patient was discharged from the hospital on the twentieth postoperative day At home he spent much time in bed al



FIG 73 — Case 29 (50813) Photograph of posterior view of surgical specimen consisting of body and tail of pancreas spleen and large carcinoma T arising from superior border of body of pancreas

though he was up and about for short intervals during the day. After the first 2 weeks however his appetite failed, he became very weak, icterus continued to increase and the drain site in the abdominal incision reopened with discharge of serosanguinous fluid. He expired suddenly on the thirty-ninth day following operation.

Necropsy revealed a large spherical metastasis within the liver near the porta and almost occluding the right and left hepatic ducts by pressure. This metastasis was not apparent until the liver had been removed from the body and was sectioned.

In the following patient carcinoma of the distal portion of the body of the pancreas was not suspected preoperatively.

Case 3 —I. di. (12,186) female [illegible] years of age. The patient stated she had had stomach trouble for many years and that fatty foods produced upper abdominal discomfort. Roentgenologic examination in another hospital some months previously had revealed a nonfunctioning gall bladder. She was admitted to this hospital on January 1? 1944 stating that for the previous 2½ months another type of pain had developed. This was in the upper left quadrant, radiated around the body to the back and seemed to be aggravated by fatty foods. The upper abdomen had also become tender, the umbilicus was especially tender. There was some loss in weight but no exact estimation of this. Physical examination was negative except for tenderness in the upper abdominal muscles and a firm nodulosity to the umbilicus suggesting metastatic carcinoma. Roentgenographic examination revealed nonvisualization of the gall bladder after oral administration of dye. The clinical impression was cholecystitis and probably intra-abdominal malignant neoplasm that had metastasized to the umbilicus.

Operation was performed on January 15 1944 as follows

SUBTOTAL GASTRECTOMY PARTIAL PANCREATECTOMY
SPLENECTOMY OMPHALECTOMY

1 A high midline incision was made.

2 Palpation and inspection of the upper abdomen revealed a moderately distended gall bladder filled with small concretions. On the lesser curvature of the stomach in the gastric wall itself there was a rounded dense mass about 4 cm in diameter having the gross appearance of a malignant neoplasm; there were several other similar but smaller nodules scattered over the lower walls of the stomach. The lymph nodes along the lesser curvature were enlarged and firm. The falciform ligament was studded with metastatic nodules and a disk-shaped mass about 3 cm in diameter was present on the deep surface of the umbilicus. In the tail of the pancreas there was an oval dense mass 4 cm in diameter, obviously a carcinoma. No metastases were visible or palpable in the liver. The situation was interpreted as either two primary malignant tumors, one in the

tail of the pancreas and one in the stomach, or a primary carcinoma of the pancreas with metastases to the stomach Partial gastrectomy and resection of the distal portion of the body of the pancreas were decided upon, inasmuch as there were no hepatic metastases and no peritoneal spread beyond that mentioned above

3 The pylorus was transected and the distal stump invaginated The gastrosplenic vessels were divided and ligated during this step The stomach not adherent to the pancreas was retracted upward

4 The body of the pancreas was transected in the mid portion and the proximal stump was closed by interlocking mattress sutures The splenic vessels were ligated and divided at this level Mobilization and resection of the distal half of the body of the pancreas and the spleen were carried out

5 Subtotal gastrectomy was performed leaving about one sixth of the stomach and a Polya type gastrojejunostomy (posterior) without enteroenterostomy There were no visible metastatic nodes on the serosa of the remaining portion of the stomach

6 The falciform ligament, exhibiting metastatic nodules and the umbilicus bearing a tumor were resected en masse by elliptical incisions through the abdominal wall

7 The gall bladder wall was slightly thickened and it contained many small faceted concretions The condition of the patient was not very satisfactory at this moment and cholecystectomy was not performed

8 Closure of the abdominal wound was made with soft rubber drains to the site of the spleen and the pancreas

Study of the surgical specimens (Fig 76) revealed that the growths in the stomach were all subserous or intramural and did not penetrate into the mucosa The neoplasm in the distal portion of the pancreas was a typical carcinoma in gross appearance Histologic study revealed adenocarcinoma primary in the distal portion of the body of the pancreas with multiple metastases to the gastric wall falciform ligament and umbilicus

Convalescence was rather stormy at first because of failure of the gastrojejunal anastomosis to function However the patient was supported by parenteral nourishment in the form of glucose gelatin and casein digest By the end of the third week oral feedings were retained and she was permitted out of bed She was discharged on the forty fourth day after operation At home she was fairly active and her appetite returned There was freedom from pain However 3 months after operation she re



Fig 70 —Case 30 (925180) Surgical specimens consisting of *P* tail of pancreas and spleen resected because of *C* primary carcinoma in pancreas *S* lower five sixths of stomach excised because of numerous metastatic nodules in serosa and larger metastatic mass *M* in lesser curvature *U* umbilicus and falciform ligament also excised because of multiple metastatic nodules in these structures No visible or palpable metastases in the liver at the time of operation Satisfactory palliative response for brief period (see text)

turned to the outpatient clinic stating she had a great desire to eat but that partaking of moderate amounts of food caused bloating and occasional emesis. Palpation revealed a large deeply seated mass in the epigastrium and a metastatic nodule in the upper portion of the healed laparotomy scar. X ray therapy was then given but was not well tolerated and was discontinued after a small dose. The patient then became rapidly weaker and died at home in an asthenic state on May 19, 1944—4 months after operation.

In another patient—Case 49, I ar (162585), white female seventy four years of age—the entire body of the pancreas and spleen were resected for carcinoma which formed a rounded tumor mass just distal to the neck. There were metastases in the liver and periaortic lymph nodes and the resection was carried out in attempted palliation of the epigastric pain due to the neoplasm. Immediate postoperative recovery was satisfactory but death occurred suddenly on the fourth day. Necropsy revealed intrahepatic thromboses in the radicals of the portal vein as the cause of death.

Where neoplasms of the body of the pancreas have extended proximally in this organ and have infiltrated the subjacent termination of the superior mesenteric vein and the first segment of the portal vein the growth is inoperable (see chap xx). However such extensions may not be apparent when the resection is begun and become obvious only when these large vessels are inadvertently opened during the resection. Such extensions are not readily apparent because of the close approximation of the neck of the pancreas and the termination of the superior mesenteric vein.

The following is an example of this.

Case 61—Kris (298980) female 70 years of age. Admitted on December 6 1942 complaining of pain in the left epigastrium coming on spasmodically at first 5 months previously but with marked increase in severity during the immediately preceding 3 weeks. In the latter period it developed about 2 hours after meals and was relieved by lying down. Suspecting a peptic ulcer she placed herself upon a milk and cream diet but this did not afford relief. There had been loss of 23 pounds weight in the previous 6 weeks. Physical examination revealed a firm tender mass about 8 cm in diameter in the left epigastrium. Roentgenologic study revealed the fundus of the stomach encroached upon by an extrinsic mass. The clinical impression was retroperitoneal sarcoma or a neoplasm of the body of the pancreas.

Laparotomy was performed on December 8 1942.

RESECTION OF BODY OF PANCREAS AND SPLEEN

1 An oblique incision was made below and parallel to the left costal arch

2 A large tumor mass was found in the upper retroperitoneal region apparently arising from the entire body of the pancreas and extending into the peripancreatic tissues and upper periaortic lymph nodes There was a single metastatic nodule in the anterior aspect of the right lobe of the liver The spleen was enlarged to about twice normal size apparently from splenic vein obstruction

3 Resection of the body of the pancreas and spleen was decided upon as a palliative measure to relieve if possible the severe epigastric pain Accordingly the gastrocolic omentum was divided the stomach retracted upward and the transverse colon downward

4 Ligation and division of the gastrosplenic vessels was carried out to permit of further upward retraction of the stomach The main mass of the neoplasm extended into the hilus of the spleen

5 Transection of the body of the pancreas was begun in the region of the superior mesenteric vein and as the tumor was dissected in this region the vein was opened Copious hemorrhage occurred which was arrested with some difficulty As clamps were applied to the bleeding areas in the tumor infiltrated area hemorrhage occurred in adjacent areas due to the friability of the tumor tissue When the bleeding was finally arrested the superior mesenteric vein had been completely ligated and there was a defect of about 5 cm in its terminal portion By this time the patient s condition was poor Blood pressure readings could not be obtained

6 The body of the pancreas the surrounding tumor tissue and the spleen were excised rapidly

7 The abdominal wound was closed with a gauze pack to the ligated stump of the pancreas in order to arrest oozing

An hour after the patient was returned to her room she died without having regained consciousness

The surgical specimen consisted of the body and tail of the pancreas involved by the tumor and weighing 116 gm It measured 14 cm in length and 7 cm at greatest width The spleen weighed 412 gm

Histologic study revealed the neoplasm to be a lymphosarcoma

Necropsy confirmed the complete occlusion of the superior mesenteric vein The upper periaortic lymph nodes were involved by lymphosarcoma There was also extensive hemorrhage in the peritoneal cavity (residual blood not sponged out after the arrest of the hemorrhage from the superior mesenteric vein)

Another instance of neoplasm near the neck of the pancreas with infiltration of the superior mesenteric vein and the first segment of the portal vein is related in chapter xx, Case 58. In this patient ligation of these vessels, which had been normally patent, was not immediately fatal.

Since carcinoma of the body of the pancreas usually manifests itself late in its course, it would appear that the demonstration of the feasibility of resection of this portion of the gland would not affect the outcome in so far as most patients are concerned, except for affording some relief from the constant pain. As is the case with advanced abdominal cancer in general, many operations are necessary to obtain a few gratifying results, but the latter would not be obtainable if a large series were not attempted. The following patient is an example of much greater palliation than that obtained in the instances previously described.

Case 2.—J. I. (233821), white male, 32 years of age. Admitted on January 1, 1940, because of attacks of hyperinsulinism. These were first noted at long intervals in 1937 but had become much more frequent by the summer of 1939; they were induced by fatigue, failure to eat regularly, muscular exercise, etc. During the attacks the blood glucose level fell to 32 mg. per cent. In September, 1939, he had been operated upon in another institution, at which time two tumors were found in the tail of the pancreas, one 7 cm. in diameter and one adjacent to it, about 1 cm. in diameter. A biopsy of the latter was taken and diagnosed "islet cell carcinoma." The abdomen was closed. Attacks of hyperinsulinism continued, occurring once to several times a day. At this admission a typical attack was allowed to develop and the clinical diagnosis was confirmed. Palpation of the abdomen was negative. Laparotomy was advised to resect the tumors if possible. This was performed on January 4, 1940, as follows:

RESECTION OF BODY OF PANCREAS AND SPLEEN AND PORTIONS OF GASTRIC AND JEJUNAL WALL (FIG. 77)

1. A high inverted T incision was made in the transverse component just above the umbilicus and in the vertical component in the mid line.

2. In the upper posterior abdomen, arising from the entire body of the pancreas, was a spherical solid tumor mass about 15 cm. in diameter. There were no hepatic metastases or evidences of peritoneal spread.

3. Numerous adhesions were divided and the gastrocolic omentum was incised. The colon was retracted downward and the stomach upward. The neoplasm was firmly adherent to the posterior gastric wall and to free this the muscularis of the latter was incised over an area approximately 8 × 4 cm. The gastric wall was tucked together, closing the thinned portion. The gastrosplenic vessels were divided and the spleen was mobilized over the diaphragmatic surface by the severance of adhesions and the splenodiaphragmatic ligament. The inferior aspect of the

tumor was adherent to the first loop of the jejunum over a segment about 5 cm long and this was liberated by incision through the muscularis

4 The spleen was grasped by the right hand and brought upward This elevated the large tumor mass The neck of the pancreas was transected care being exercised to avoid injury to the superior mesenteric vessels The tumor and spleen were then excised

5 After hemostasis the abdomen was closed with a soft rubber drain to the excision site

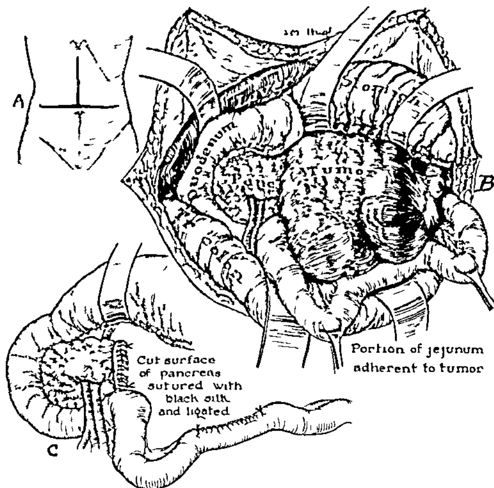


FIG 77 —Case 2 (233821) Schematic representation of large insulin producing islet-cell carcinoma of body of pancreas infiltrating posterior gastric wall and attached to first loop of jejunum and posterior gastric wall The neoplasm measured 15 cm in greatest diameter A inverted T incision B showing approach via gastrocolic route tumor resected with portion of stomach wall and ileum attached to it C neck of pancreas transected and stump closed by mass ligature and continuous suture (silk) Patient lived 3 years and 11 months Died as result of portal vein ligation when attempt was made to excise recurrences and metastases

Study of the specimen (Fig. 78) revealed it to measure 15 × 13 × 10 cm. and to weigh 673 gm. Microscopic section showed neoplastic islet cells, with areas of sclerosis and calcification. Invasion of the lumina of the large veins by masses of tumor cells indicated that the neoplasm was malignant.



Fig. 78.—Case 2 (233821). Surgical specimen consisting of large insulin-producing islet-cell carcinoma of body of pancreas that had infiltrated posterior gastric wall and first loop of jejunum. *W*, segment of posterior gastric wall excised en masse with tumor; and *J*, segment of jejunal wall also resected with the tumor. Weight of tumor 673 gm.

During the 3 weeks following operation the patient was diabetic and was given insulin. This was undoubtedly due to the functional inactivity of the islets in the head of the pancreas because of hyperinsulin production by the tumor. Subsequently, the diabetic state disappeared and the patient was well and normally active for 2½ years. In July, 1942, attacks of hyperinsulinism recurred and the patient was again subjected to laparotomy. Multiple hepatic metastases were present; one was biopsied and the abdomen was closed. During the fall of 1942 attacks recurred at frequent intervals. X-ray therapy to the upper abdomen afforded some relief in

that the frequency of the attacks was decreased for a time During the winter and spring of 1943 the attacks occurred once to several times a day, and their control by injection of glucose and forced feedings was becoming increasingly difficult The patient received injections of alloxan in an attempt at chemotherapy of the neoplasm since this substance has been demonstrated to cause specific necrosis of islet cells in the pancreas of the rabbit dog, and rat with the production of diabetes Remission from attacks was possible for periods of as long as 3 weeks which facilitated return to normal physical activity A series of such injections was made from July to the end of November 1943 The patient however refused further intravenous injections and requested that another operation be performed to remove all insulin producing tissue This was performed on December 3 1944 Hepatic metastases were again noted and several were resected There were palpable metastases on the deeper surfaces but these were inaccessible for resection There was no evidence of widespread peritoneal dissemination The head of the pancreas—all that remained of this organ—was contracted and firm Its removal with the duodenum was then attempted Cicatrization in the region had distorted anatomic relationships and the first segment of the portal vein was opened By the time the hemorrhage had been arrested the portal vein had been completely divided and was clamped and the superior mesenteric vein also had been clamped The transected ends of these veins were separated by several centimeters and their approximation was impossible although it was attempted for a considerable period The operation was terminated by excision of the head of the pancreas and duodenum gastrojejunostomy and choledochojejunostomy and the abdomen was closed with a soft rubber drain to the excision site

The patient died 2 hours after return to his room Necropsy revealed metastases only in the liver there was no gross or microscopic evidence of carcinoma elsewhere Histologic study of the surgically resected head of the pancreas and of the metastases revealed no evidence of specific necrosis of normal or neoplastic islet cells as a result of the previous injections of alloxan

The patient had survived 3 years and 11 months following the resection of the large neoplasm and was normally active during most of this period A feature of unusual interest is that the subject was a large man 6 feet 3 inches in height and weighed 210–35 pounds no weight was lost—in fact a gain in weight occurred following the laparotomy in August 1942

when multiple hepatic metastases were found This was due to the fact that he continued to ingest large amounts of food by frequent feedings in an attempt to control the attacks of hyperinsulinism *This demonstrates that "carcinoma cachexia is not the result of a specific toxin elaborated by malignant cells but is the result of self-starvation due to a series of circumstances which lead patients gradually to reduce their caloric intake The importance of maintaining adequate nutrition in the palliative management of patients with advanced cancer is thus demonstrated*

In connection with the question of how much pancreas may be left in situ to avoid diabetes it may be stated that only a small portion of the head is necessary for adequate internal secretion of insulin In one patient with cystadenoma involving almost the entire pancreas the writer left only a portion of the head measuring approximately 2 × 0 5 cm Blood glucose levels were normal immediately after operation and have remained normal for over 5 years the patient continuing in good health Apparently sufficient external secretion of the pancreas which does not seem indispensable for normal fat absorption *in all patients is also* afforded by such fragments Regeneration of the pancreas is said to occur in dogs after subtotal resections although it does not occur to an appreciable extent in monkeys and in the writer's experience it does not occur to an appreciable extent in man

TOTAL PANCREATECTOMY

Removal of the entire pancreas may be envisaged where a large portion or all of the organ is involved by carcinoma *Usually under these circumstances* metastases have developed but the operation might be performed once the abdomen is open for palliation in relief of pain since carcinoma of the pancreas is often accompanied by severe intractable pain Total pancreatectomy was performed by the writer on three occasions for advanced carcinoma In two instances there was practically complete involvement of the organ by carcinoma and the outstanding complaint in addition to obstructive icterus was severe epigastric pain It was to relieve the latter that the procedures were carried out *In one—Case 48* Hint (302199) (Fig 79) a male sixty seven years of age—there were metastases in the liver The patient died on the second day postoperative and necropsy revealed massive bilateral pneumonia *In the other—Case* 53 Rich (309791) a male twenty nine years of age (Fig 80)—there were no hepatic metastases although roentgenograms had revealed a mediasti



Fig 79 —Case 48 (302100) Surgical specimen consisting of entire pancreas (bisected) almost completely replaced by carcinoma One-stage pancreatoduodenectomy was performed with removal of lower pylorus, duodenum upper few centimeters of jejunum and spleen Latter viscera dissected off specimen and not shown in photograph

Fig 50 — Case 33 (309 01) Surgical specimen obtained from total pancreatectomy S spleen B body of pancreas H head of pancreas D entire duodenum P pylorus J upper end of jejunum T (*black arrow*) level of ligament of Treitz Entire pancreas infiltrated by carcinoma Patient survived 10 days and died of exhaustion (?) Diabetes was not severe and easily controlled (see text)

nal mass The patient died on the ninth day postoperative of exhaustion' In each instance the procedure was as follows

TOTAL PANCREATECTOMY AND DUODENECTOMY PARTIAL GASTRECTOMY WITH SPLENECTOMY

1 A high mid line incision was made with a horizontal extension to the left for a distance of 8 cm from the mid point of the mid line incision

2 The gastrocolic omentum was divided with retraction upward of the stomach and retraction downward of the transverse colon The body and tail of the pancreas were exposed

3 Transection of the stomach in its lower fourth was carried out with invagination of the upper end

4 The parietal peritoneum was incised along the convex border of the duodenum and the latter with the head of the pancreas were mobilized Transection of the common bile duct was made at the level of the superior border of the first portion of the duodenum and an aspirating cannula was inserted in the upper segment

5 The ligament of Treitz was transected and the duodenojejunal junction was carried to the right beneath the superior mesenteric vessels

6 The jejunum was transected 3-4 cm below the junction with the duodenum and the lower jejunal segment was invaginated

7 The gastrosplenic vessels were transected

8 The spleen was grasped in the right hand and used as a handle after severance of the lienodiaphragmatic and lienocolic ligaments to elevate the tail and body of the pancreas When these were brought upward the splenic vessels were identified and transected above the neck of the pancreas

9 The neck of the pancreas was carefully dissected away from the underlying superior mesenteric vessels and the entire pancreas together with the spleen the duodenum and the lower segment of the stomach was removed

10 Gastrojejunostomy (Billroth II) was performed

11 Choledochojejunostomy was performed 12–15 cm distal to the gastrojejunostomy

12 The abdominal wound was closed with drainage of the excision sites

The following patient appears to be a unique instance among the patients so far subjected to total pancreatectomy in that he was already a moderately severe diabetic before the operation

Case 45.—Webst (398918), white male, 53 years of age. Admitted to the medical service February 24, 1944, because of watery, *foamy stools*, several to as many as twenty a day for the previous 2 years. There had been some abdominal pain at first, but this *did not* continue. There was loss of 50 pounds weight during this period, yet his appetite remained "ravenous." A complete examination was carried out. The blood was normal. The presence of *typical steatorrhea* was confirmed. He was found to be rather severely diabetic and required 60-90 units of insulin daily, with carbohydrate intake of 400-900 gm., and the total caloric value of the daily diet varying from 2,500 to 3,500 calories. Roentgenographic examinations of the stomach, duodenum, chest, and colon were negative. The writer saw the patient in consultation and felt that surgical exploration was not indicated, as he was improving on medical management and was having no pain (March, 1944).

He was discharged from the medical service on May 14, 1944. There was no pain, and he had gained *37 pounds in weight*. Pancreatin seemed to have no effect upon the number and quality of the stools. The latter at first contained much fat, but later this was reduced, although they continued to be soft.

He was readmitted on August 24, 1944, because of moderately severe icterus of 3 weeks' duration, pruritus, 1 month, abdominal pain in right upper quadrant, at times very severe, 1 month. Improvement in diarrhea was maintained, in that during the first week in the hospital he had only two stools a day. Direct Van den Bergh 5.6 mg. per cent, indirect 7.5 mg. per cent. Examination of the abdomen was negative except for moderate enlargement of the liver. The gall bladder was not palpable.

Exploratory laparotomy was now thought to be indicated and was performed on September 7, 1944, as follows:

TOTAL GASTRECTOMY, TOTAL PANCREATECTOMY, TOTAL DUODENECTOMY, SPLENECTOMY, SUBTOTAL OMENTECTOMY, LEFT ADRENALECTOMY (FIG. 81)

1. The abdomen was entered through a high mid-line incision. It was immediately apparent that the greater omentum, although not adherent to the surrounding structures, contained numerous spherical metastatic nodes. Before anything further was undertaken, the entire redundant portion of the omentum was resected by incision along the attachments to the transverse colon. The gall bladder appeared normal, contained no stones, and was not distended. The common duct was slightly enlarged.

2. Exploration revealed no gravitational metastases in the pelvis, and there were no metastatic nodules in the liver. The stomach appeared to be bound down by adhesions on its posterior wall. The gastrocolic omentum was divided, and the transverse colon was retracted downward. It now became evident that the primary growth was in the mid portion of the body of the pancreas and that there was direct extension into the posterior gastric wall and especially into the nodes along the lesser curvature. The latter formed a dense, matted mass extending almost to the esophagus.

3. The duodenum and the head of the pancreas were mobilized by incision of the peritoneum along the greater curvature of the duodenum

The ligament of Treitz was transected and the duodenojejunal junction was mobilized The superior mesenteric vein was exposed below its emergence from beneath the neck of the pancreas The duodenojejunal junction was transected with invagination of the distal stump

4 The right and left gastric vessels were divided and ligated The head of the pancreas and the duodenum were mobilized and elevated By sharp dissection the neck of the pancreas was elevated from the superior mesen

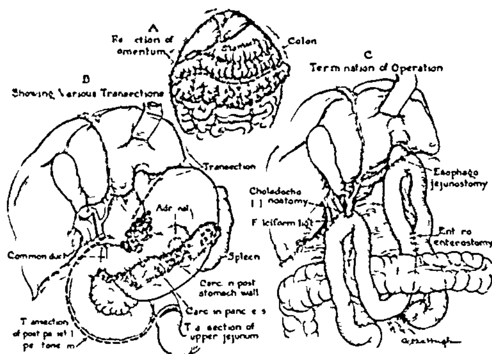


FIG 81 —Case 45 (528218) Depicting operation described in text omentectomy (for metastases) and then total gastrectomy total pancreatectomy total duodenectomy etc

teric vessels The duodenum and the head of the pancreas were retracted downward and the common duct was transected at the level of the upper border of the first segment of the duodenum below this level it was apparent that the common duct was infiltrated and constricted by neoplastic extension from the pancreas The duodenum the head of the pancreas and the lower stomach were now mobilized

5 The right hand was passed over the diaphragmatic aspect of the spleen and the splenodiaphragmatic ligament was divided The spleen was brought downward and mesially to mobilize the tail of the pancreas and the greater curvature of the stomach The splenocolic ligament was divided

6 Dissection to elevate the entire body of the pancreas en masse with the stomach was begun, just to the left of the level of the superior mesenteric vessels, since the head of the pancreas and the duodenum had been mobilized up to that point In dissecting free the body of the pancreas the latter fragmented and seemed to be completely replaced in its central portion by a tumor, which was densely adherent to the posterior upper retroperitoneal tissues All gross evidence of tumor and pancreas was elevated The spleen was again elevated and thus brought up the freed tail of the pancreas As the involved portion of the pancreas was being mobilized it became apparent that the left adrenal gland, which was adherent to it because of tumor infiltration was also being mobilized for excision

7 The entire stomach the entire pancreas and the spleen were now elevated over the left costal arch The first long loop of jejunum was brought up behind the colon to the posterior aspect of the cardiac end of the stomach and attached to it by interrupted silk sutures The stomach and other structures were then cut away the level of transection being about 2 cm below the esophagogastric junction Anastomosis between the jejunum and the upper fragment of the stomach was made with two rows of interrupted sutures Enteroenterostomy was performed between the afferent and the efferent jejunal loops below the level of the transverse mesocolon

8 The second long loop of the jejunum was brought upward anterior to the transverse colon and choledochojejunostomy was performed Interrupted sutures were then placed between the jejunum distal to the anastomosis and the falciform ligament to support this loop

9 The abdomen was closed with a Pezzer catheter drain in the left upper quadrant and a large gauze pack was inserted within a sheet of perforated Silkoid to serve as a Mikulicz type drain

The surgical specimen is illustrated in Figure 82 the total weight was 845 gm Histologic study revealed a duct cell carcinoma [1]

The postoperative course was remarkably smooth Nothing was received by mouth for 10 days casein digest and glucose were given intravenously Food by mouth was gradually increased until the patient re

[1] The head neck and proximal portion of the body of the pancreas were involved by carcinoma except for a narrow zone along their superior margin extending to invade the lower segment of the common duct There was ample normal pancreatic tissue present to afford normal carbohydrate metabolism had there not been concomitant diabetes The latter was thus not due to extensive invasion and replacement of the pancreas by the carcinoma Histologic study of the uninvolved pancreas by Dr C Connor revealed degenerative changes in the islets of Langerhans characteristic of diabetes

ceived a full diet by the end of 3 weeks to the equivalent of 2 500 calories The metabolic studies are summarized in Table 11

Neither of the first two patients mentioned above—Cases 48 and 53—survived for sufficiently long intervals to permit of the study of their insulin requirements over a significant period In the second patient (Case



Fig 82 —Case 53 (325 18) Surgical specimen obtained from operation depicted in Figure 81 showing St practically entire stomach (except for small portion immediately below esophageal orifice) *M* metastatic nodules along lesser curvature *D* entire duodenum *P* head of pancreas *BT* body and tail of pancreas (containing primary tumor) *Al* left adrenal adherent to pancreas *Sp* spleen *O* practically entire omentum riddled with metastatic nodules

53 male twenty nine years of age) the survival for 9 days did permit of the observation that the insulin requirement was much less than anticipated Indeed because of this fact a severe hypoglycemic reaction developed on the second day as a result of administration of theoretically required amounts of insulin On the day of operation he had received among other things 4 000 cc of 5 per cent glucose solution The fasting blood sugar on the morning of the second day was 292 mg per cent and

TABLE 11

Case 45 Webst (328918) Diabetes Mellitus and Carcinoma of Body of Pancreas Insulin and Dietary Intake before and after Total Pancreatectomy and Total Gastrectomy

Date	Dietary Intake				Insulin*	Blood Sugars (Mg %)				Urine—Sugar			
	Carb	Prot	Fat	Cal	Protam Reg	7 00 A M	11 00 A M	4 00 P M	7 00 P M	7 00 A M	11 00 A M	4 00 P M	7 00 P M
Just before operation													
9 3-44	400	200	35	2 715	50 u+25 u					2+	2+	0	0
9-4-44	400	200	35	2 715	50 u+30 u	259				+	+	0	3+
9-5-44	400	165	10	2 350	50 u+30 u	207	181	209		0	2+	0	3+
9 6-44	400	200	35	2 715	60 u+30 u	191	97	200		tr	tr	tr	0
9 7-44 (operation)													
Three weeks after operation													
9 28-44	404	115	15	2 211	30 u+15 u	217	248	302	352	2+	+	2+	+
9 29-44	411	127	18	2 314	30 u+25 u	209	305	150	93	2+	0	tr	0
9 30-44	400	103	23	2 219	30 u+15 u	43	134		55	0	0	0	0
10 1-44	391	102	23	2 179	30 u+ 5 u	43	114	252	254	0	0	0	0

* Insulin requirements postoperatively appear to be about half of preoperative requirement

OTHER DATA

	Plasma Protein	R B C	Hb	Blood Calcium	Blood Phosphor
7 months preoperative	6 05 gm %	4 38 M	13 gm	9 6 mg %	3 2 mg %
3 weeks postoperative	7 35	5 76	16	8 6	3 6

Blood Lipid		Blood Amylase		Serum Cholesterol	
7 months preoperative	800 mg %	preoperative	32 units	7 months preoperative	147 mg %
5 months preoperative	1 260	1 week postoperative	0	4 days postoperative	153
5 days postoperative	1 007	3 weeks postoperative	10	2 weeks postoperative	260
2 weeks postoperative	987	5 weeks postoperative	60	4 weeks postoperative	210
4 weeks postoperative	855				
5 weeks postoperative	850				

	0 hour	15 minutes	30 minutes	1 hour	2 hours
Intravenous glucose tolerance test (5 weeks postop) 50 cc 50% glucose in 2 minutes	146 mg %	268 mg %	238 mg %	210 mg %	182 mg %

20 units of regular insulin without glucose were given Six hours later he was in severe hypoglycemic shock with a blood sugar level of 14 mg per cent Following intravenous injection of 50 gm of glucose the blood sugar returned to normal (127 mg per cent) During the next 48 hours no insulin was given, the blood sugar rose to 410 mg per cent Insulin was again given in doses of 5 units and progressively increased to 10 15 and 20 units with infusions of 1 000 cc of 5 per cent glucose On this regime the blood glucose levels were maintained between 90 and 200 mg per cent It finally became evident that 50 units of insulin per day with administration of 150 200 gm of glucose sufficed to maintain the blood glucose at satisfactory levels The CO_2 combining power of the serum was normal throughout the period of observation Essentially similar observations were made in another patient subjected to total pancreatectomy for carcinoma by Dr D I Clark and have been reported by Goldner and Clark Rough calculations of insulin and glucose injections showed that the ratio was never lower than 1 (insulin) to 4 (glucose)

The more detailed studies of Case 45 are given in Table 11 The most surprising feature of the data is the fact that the insulin requirements in this diabetic patient were less 4 weeks after total pancreatectomy than before this operation was performed Furthermore the intravenous glucose tolerance test yielded a curve characteristic of mild diabetes The blood lipids and cholesterol did not change significantly The blood amylase was 9-10 units for 3 weeks after operation and rose to 66 units by the fifth week The plasma proteins had been sustained within the normal range Two months after operation the patient was well and ambulatory However he died of carcinomatosis 3½ months after operation His deterioration was very rapid

Another patient—Case 84 (348369)—was subjected to subtotal gastrectomy total pancreatectomy splenectomy and transverse colectomy for sarcoma involving the above structures (Fig 83) The operation was completed by gastrojejunostomy and double barrel colostomy (hepatic to splenic flexures) The patient survived 19 days dying of peritonitis due to leakage of the gastrojejunal anastomosis It was not possible to obtain accurate studies of the degree of postoperative diabetes Suffice it to state that this did not appear unusually severe or difficult to control

In Rockey s patient where all but less than one gram of pancreas was removed the patient surviving for 15 days the postoperative diabetes was controlled with 27 units of regular insulin daily



Fig. 83. Case 81 (318360). Surgical specimen consisting of S, lower seven-eighths of stomach; D, entire duodenum; Sp, spleen; P, body and tail of pancreas; H, head of pancreas involved in T, round-cell sarcoma which also infiltrated into posterior wall of stomach; and C, C', transverse colon also resected en masse with above because of involvement by neoplasm. O, omentum. Patient lived 19 days and succumbed because of leakage of gastrojejunal anastomosis.

In Fallis' patient briefly reported by McClure, in whom total pancreatectomy with duodenectomy and splenectomy was performed for carcinoma, the patient was back at part time work 3 months later requiring 25 units of protamin insulin a day with 8 units of regular insulin, the latter being added only 2 days a week. In Priestley's case of total pancreatectomy for small islet cell adenoma, the patient's diabetes was controlled for several months with only 10 units of insulin daily. Thus in both the latter two cases where diabetes did not exist prior to operation, the insulin requirements were just a little less than in Case 15, who had rather severe diabetes before operation. New light is shed upon the status of the pancreas in human diabetes mellitus by these observations. Certainly it is now apparent that pancreatic tissue is not indispensable for life.

In view of the feasibility of total pancreatectomy and survival without irremediable profound physiologic disturbances, it is suggested that this operation might be performed for cancer of the body of the pancreas when the entire organ has not yet been replaced by carcinoma, since it is well known that when these growths are established in the pancreas they permeate the gland for a considerable distance beyond the gross limits of the process and therefore may not be excised by what might appear to be an adequate segmented resection.

CHAPTER XIII

OPERATIONS FOR HEPATIC NEOPLASMS

THE vast majority of malignant hepatic neoplasms encountered at laparotomy are secondary growths from primary tumors elsewhere. Solitary metastases that are readily accessible *might be excised if the* primary growth and its extensions are also resected. Such procedures can*not yet be generally advocated*; the very presence of these metastases constitutes a classical sign of an advanced stage of malignant disease with poor prognosis. Instances of such operations have on rare occasions been mentioned (Cattell, Wangensteen), but sufficient case records are not available to permit of a definite evaluation of the results and a statement as to whether the procedures are worth while. The writer has performed excision of hepatic metastases at the time the primary growth was re*sected in several patients*.

In 2 patients hepatic metastases were resected as follows:

Case 83. S. (347132), male, fifty-six years of age, suffering from severe and almost constant epigastric pain with a palpable epigastric mass, was found at laparotomy to have a carcinoma of the body of the pancreas and one metastasis 3 cm. in diameter, in the right lobe of the liver.

The body and tail of the pancreas, together with the spleen, were resected after incision of the gastrocolic omentum, retraction of the stomach upward, and retraction downward of the transverse colon. A wedge-shaped *segment of the right lobe of the liver* was then resected to encompass the metastasis, and the cut edges of the liver were approximated after being sewed over with a continuous catgut suture. *The surgical specimens are* shown in Figure 84.

The immediate postoperative course was satisfactory, *and the patient* was ambulatory and fairly comfortable following discharge from the hospital. After several weeks pain recurred, icterus developed, and he died at home 6 months after the operation. Prior to death there were metastatic nodules in the laparotomy scar.

The second patient—Case 89 (349169)—a female, fifty-six years of age, was admitted because of a sudden onset of acute pain in the right upper quadrant which lasted 24 hours. A mass, thought to be the distended gall

bladder was palpable There had been excessive eructations and flatus during the previous two months no nausea or vomiting She was observed for several days in the hospital The temperature varied from 100° to 102° F Cholecystograms revealed a calcified stone and nonvisualization of the gallbladder Because there was little symptomatic improvement laparotomy was performed under the diagnosis of cholecystitis This re



FIG 84 —Case 83 (347132) Surgical specimens consisting of *P* body and tail of pancreas with *C* carcinoma *Sp* spleen *L* wedge shaped segment of liver including *M* metastasis Patient survived operation for 6 months receiving brief palliation and died of carcinomatosis

vealed a small fibrotic gall bladder containing a single concretion. In the liver were several large metastatic neoplastic masses, and it was one of these that afforded the mass which was palpable upon physical examination and thought to be the gall bladder. Visual and manual exploration of the remainder of the abdomen failed to reveal a possible primary growth. The major portion of the left lobe was resected because it contained a large metastasis. Two large and several small metastases were removed from the right lobe of the liver by enucleation, which was easily accomplished. The gall bladder was excised (Fig. 85). Histologic study of the metastases revealed them to be composed of small, closely packed, very anaplastic cells; there was no suggestion as to the primary source. Convalescence was uneventful, and there was relief from the severe epigastric pain present before operation. Following discharge from the hospital relief from pain continued, but, after a few weeks, marked asthenia was rapidly progressive, and the patient died 3 months after the operation.

Primary benign neoplasms of the liver have been resected on a number of occasions, but the experience of individual surgeons is quite limited. The commonest benign operable neoplasms of the liver are cysts and angiomas. Benign hepatomas are less frequently encountered.

Primary carcinomas of the liver arise from the hepatic cells themselves and more often from the bile ducts. Upon inspection and palpation it is not possible to ascertain whether the tumor is benign or malignant when the growth is solitary.

The first comprehensive reports on excision of hepatic tumors are the papers by W. W. Keen published in 1892, 1897, and 1899. Each of these dealt with 1 case operated upon by him: the first was an adenoma, the second an angioma, and the third a carcinoma involving practically the entire left lobe of the liver. The latter, including the neoplasm, was practically completely removed by incision with Paquelin cautery. "Five large vessels . . . were ligated individually. Iodoform gauze was packed against some of the remaining raw surface and removed on the second day. Convalescence was uneventful." In commenting upon his experiences with these 3 cases, Keen, in 1899, made the following remark, which is quoted in connection with the general thesis of this essay: ". . . after my experience with these three cases I should hardly hesitate to attack almost any hepatic tumor without regard to its size." In this report he also collected 76 instances of neoplasms of the liver which had been subjected to operation and reported up to 1899.

A review of the literature up to 1915 by L. C. Yeomans revealed 16 reported cases of resected primary liver carcinoma of which 6 remained alive and well from 3 to 7 years. Wendel's case is spectacular and deserves special mention. In 1910 the right lobe of the liver bearing a large adenocarcinoma was resected together with the adherent gall bladder. The specimen weighed 940 gm. In 1912 a second operation was performed at

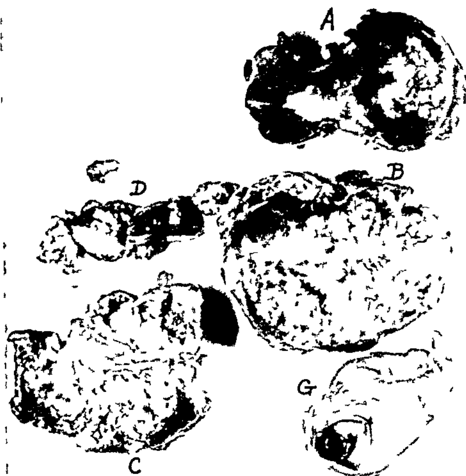


Fig 85.—Case 89 (349169). Photograph of surgical specimens consisting of *A* major portion of left lobe of liver with metastasis; *B* and *C* two large metastatic masses removed from right lobe; *D* four small metastases also removed from the right lobe; *G* gall bladder containing solitary concretion. Patient survived operation for 8 months dying presumably of generalized metastases but was completely relieved of severe upper abdominal pain present prior to operation.

which time metastatic nodules were found in the right retroperitoneal spaces and adherent to the mesentery of the transverse colon The lower ileum, cecum ascending colon right portion of transverse colon and adherent retroperitoneal tissues were resected with ileotransverse colostomy The patient remained well for seven years and died in 1919 Necropsy revealed carcinomatosis including the left lobe of the liver This was a 9 year survival following the first operation and a 7 year survival following the second operation for extensive recurrences

More recently Wallace collected 29 cases of resection of hepatoma in the literature reported up to 1941 there were 23 immediate survivals In 12 instances follow up reports were available and among these 5 remained alive for less than 2 years 3 for 3 years and 4 for more than 5 years In 1944 Packard and Stevenson reported the successful resection from the right lobe of a large malignant hepatoma weighing 452 gm, in an infant 13 months of age However 22 months later there was evidence of metastases Pickrell and Clay (1944) reported the successful resection in an elderly male of the left lobe of the liver for carcinoma that had almost completely replaced this lobe The number of successful resections of hepatomas or other hepatic neoplasms is probably much greater than the number of recorded cases would suggest (see discussion of paper by M B Tinker)

The liver exhibits remarkable regenerative powers As much as four fifths may be resected in experimental animals with survival and almost complete regeneration occurs in several weeks In Wendel s patient described above removal of most of the right lobe was followed by marked hypertrophy of the left lobe Wendel compared this to the compensatory hypertrophy of one kidney following removal of the other kidney

The blood supply of the liver is such that there are free anastomoses between all segments thus permitting various types of resection of the hepatic parenchyma without fear of vascular disturbances to the remaining portions

Hepatic neoplasms may present in various ways they may arise at the lower anterior margins protruding forward and downward with wide or narrow pedicles of attachment they may arise within hepatic tissue only one aspect being superficial and visible or they may have attained large size and replaced most of one lobe The procedure for excision varies with the manner in which the neoplasm is present A summary of the various procedures follows (Fig 86)

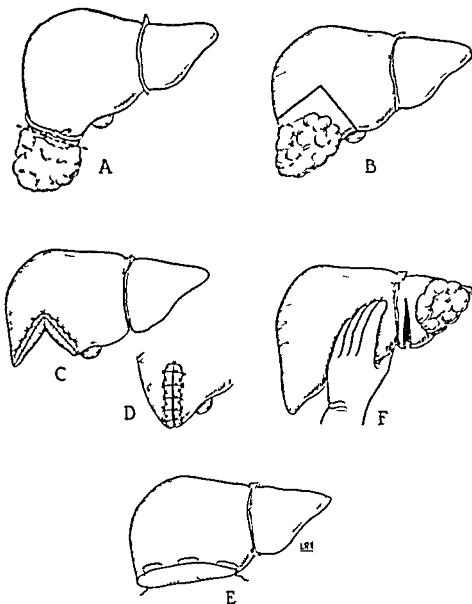


Fig 86 — A method of excising tumor of liver that has relatively narrow attachment rubber tube passed about base of pedicle for hemostasis transected base is then sutured *B* wedge-shaped excision of hepatic tumor *C* and *D* method of closure of hepatic parenchyma after wedge-shaped excision *F* method of closure of raw surface of liver by continuous mattress suture through parenchyma large round curved needles are employed *F* author s method of excision of portions or most of left lobe of liver for primary or secondary growths Pressure is exerted by hand and continued until after excision Raw surface sewed over while hand continues compression

1 If the mass is pedunculated or bulging from the extremity of a lobe the pedicle is grasped by one hand and incision is made through normal tissue just distal to it Some authors have recommended that compression about the pedicle be obtained by an elastic tube or band Hemorrhage from the fresh surface is controlled by insertion of a row of interrupted interlocking mattress sutures these being tied *slowly and firmly but not too tightly* in order to avoid cutting through the liver parenchyma Large transected vessels and ducts are ligated individually A continuous suture, taking large bites of the liver parenchyma, may also be employed

2 Cautery excision was reported more often in the older literature Gauze packs were applied to the seared surfaces and withdrawn a day or two later through the abdominal wound In addition to cauterization the *large vessels and ducts were ligated individually*

3 Wedge shaped segments of liver including the neoplasm may be resected the apex of the wedge pointing toward the hilum of the gland Prior to the resection large interrupted mattress sutures passing through the entire thickness of the organ may be inserted and tied along the lines of intended incisions The latter are then made within the area delimited by the sutures Following removal of the wedge the omentum may be sutured *into the wound or the edges may be approximated* Penberthy and Benson inserted the omentum into the defect and then approximated the cut surfaces

4 Where a large segment of the right lobe is removed and the cut surfaces cannot be approximated they are compressed by interlocking or continuous mattress sutures as described The omentum may be sutured to cover the area but this is not necessary "Raw" liver surface from which *bleeding has been controlled may* be left 'uncovered in the abdomen but soft rubber drains should be inserted to the site of excision

5 The entire left lobe may be removed by *incision just to the left of* the falciform ligament Preliminary transection of the left hepatodiaphragmatic ligaments will aid in mobilization of the left lobe *prior to its* removal

The author excised most of the left lobe of the liver for secondary involvement by carcinoma of the stomach as follows The base of the left lobe was grasped and compressed by the left hand index finger on upper surface *thumb on undersurface* With the scalpel the liver was incised halfway through just to the left of the grasping digits the large vessels were secured with hemostats *mattress sutures were inserted* through the

entire thickness of the incised portion and tied to compress the parenchyma This step terminated the left hand was quickly shifted to grasp the base of the unincised portion of the left lobe and the above procedures were repeated The falciform ligament or the omentum may be sutured over the cut surface at the termination of the operation

6 In some hepatic tumors there appears to be a sharp cleavage plane between the hepatic parenchyma and the tumor capsule Insertion of the scalpel handle or even the finger in this plane once it is demonstrated permits of easy rapid enucleation of the tumor While this essay is concerned with malignant neoplasms it may be mentioned at this point that angiomatous neoplasms do not present a formidable problem because of the danger of hemorrhage Such lesions especially if they are scirrhous often present definite encapsulation and may be easily enucleated

The presence of one or several small subcapsular nodules in the liver when there is a resectable neoplasm within the abdomen should not deter removal of the latter because of the assumption that such nodules are metastases Not infrequently such nodules when excised and examined histologically are found to be fibromas scirrhous angiomas or small cysts Biopsy and frozen section of the hepatic nodules are always indicated when there is doubt as to whether or not they are metastases and when the nature of the procedure to be carried out depends upon such spread having taken place Failure to verify histologically lesions which upon gross inspection alone are thought to be carcinoma has on not a few occasions resulted in confusion as to the correct interpretation of the patient s ultimate course and response to treatment Secondary invasion of the liver by direct extension of carcinoma primary in the stomach or colon has been considered in chapters vi and x Such secondary involvement is usually less extensive than might first be suggested from gross findings at laparotomy The capsule of the liver (Glisson s capsule) is an effective barrier to neoplastic infiltration from adjacent organs and in most instances the secondary involvement of the liver by direct extension is in reality an adhesion to Glisson s capsule rather than deeper infiltration into the liver parenchyma itself

CHAPTER XII

OPERATIONS FOR ADVANCED CARCINOMA OF THE EXTRA-HEPATIC BILE DUCTS (EXCLUSIVE OF THE AMPULLA OF VATER)

CARCINOMA of the extra-hepatic biliary system is relatively infrequent. In a review of the literature, Stewart, Lieber, and Morgan were able to collect 98 cases satisfactorily reported (exclusive of gall bladder) up to 1940 and listed 6 new cases of their own. Surgical therapy was instituted in 50 cases. The ultimate mortality was 98 per cent, the fate of 1 patient remaining unrecorded. The immediate postoperative mortality rate was 68 per cent. It would therefore appear that early diagnosis is the principal factor for successful surgical therapy, as is the case for cancer in general, but that this, with very few exceptions, has hardly ever obtained in cancer of the extra-hepatic biliary passages.

Carcinoma of the hepatic, cystic, or common bile ducts eventually produces biliary obstruction, but this is not usually an early sign, since exploratory laparotomy performed when icterus has not long been present or is not very severe usually reveals sufficient spread in the biliary ducts, even though gross metastases are not observed, to render complete extirpation impossible. Also they have often been regarded as inoperable because of location. Where metastases are extensive and where patent hepatic ducts are present above the growth, insertion of catheters into the ducts for drainage of bile to the exterior may afford palliation by relief of the icterus.

Excision of neoplasms of the upper portion of the common bile duct, lower common hepatic duct, cystic duct, or gall bladder is not difficult when such growths are of limited size and may be accomplished by resection of a segment of the ducts or by cholecystectomy if the lesion is near the fundus of the gall bladder. The continuity of the bile passages is re-established by end-to-end anastomosis over a rubber T tube after mobilization of the duodenum and the head of the pancreas by incision of the peritoneum along the convex border of the duodenum. Tubes of vitallium introduced by Pearse may also be employed for this purpose, although extensive experiences with the latter have not yet been recorded. No ex-

ternal drainage of the lumen is necessary when these tubes are employed. Eventually the tube may wander into the bowel and be passed in the stool, in which case stenosis at the site of the anastomosis may develop.

When the neoplasm is relatively large, the situation may be complicated by invasion about the hepatic artery or portal vein or both. The limits of such extensions are not readily appreciated upon first inspection and palpation because all of the porta hepatis appears involved. Palpation aids in distinguishing the portal vein (collapsible) and hepatic artery (pulsating) from solid firm tumor tissue. Insertion of a small gauge aspirating needle on a glass syringe at an acute angle to prevent continuous bleeding also facilitates location of the portal vein or of a biliary channel.

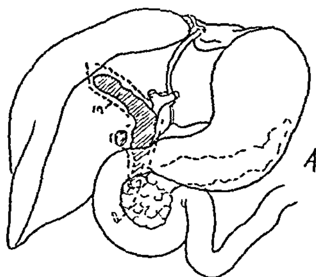
As a preliminary step in excision of a carcinoma of the common hepatic or common bile ducts, the peritoneum along the convex border of the duodenum is incised and the duodenum and the head of the pancreas are mobilized. This permits of palpation and direct inspection of the lower segment of the common duct behind the duodenum and the head of the pancreas.

Very wide resections of neoplasms in the porta hepatis are obviously not possible, but excision of all or most of the macroscopically visible neoplastic tissue affords relief for a period, at least, of obstructive icterus and consequent improvement in the patient's general condition. An example of this follows.

Case 18.—S. P. ([illegible]1586), male, [illegible] years of age. Admitted to the hospital complaining of rapidly increasing icterus of [illegible] weeks' duration, with severe pruritis, clay-colored stools and dark urine. There was no pain and no loss in strength or weight. The icteric index was 115. The clinical diagnosis was carcinoma of the ampulla of Vater. Laparotomy was performed on June 13, 1941, as follows:

CHOLECYSTO-CHOLEANGIO-CHOLEDOCHECTOMY, RESECTION OF PORTION OF HEAD OF PANCREAS (FIG. 87)

1. A right high paramedian incision was made.
2. No evidence of carcinomatosis was encountered. The liver appeared enlarged and tense. The region of the ampulla of Vater was negative to palpation.
3. The gall bladder was markedly contracted and firm and was surrounded by dense adhesions. The firmness of the gall bladder was continuous with a hard mass situated in the porta hepatis and obviously involving the lower common hepatic and upper common bile ducts. The latter mass



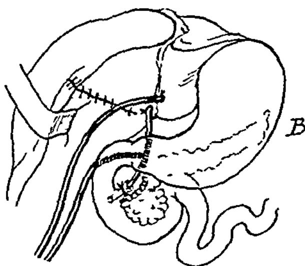


Fig. 87.—Case 18 (204580).—A, schematic representation of excision of carcinoma involving gallbladder, lower common hepatic ducts, and upper common bile duct, with a metastatic nod; dotted lines indicate incisions for wedge-shaped excision of liver about carcinomatous gallbladder. *B*, termination of operation; the hepatic ducts were divided at their exit from the liver and the common duct divided near its entrance into duodenum; portion of head of pancreas removed. T tube between right hepatic duct and stump of common duct; catheter in left hepatic duct. Patient was relieved from icterus and returned to work for several months. Marked palliation for 1 year, then death from carcinomatosis (see text).

measured about 4 cm in diameter There was one discrete enlarged firm lymph node adjacent to the mass The right and left hepatic ducts were free for about 1 cm above the mass and were dilated the common duct appeared thickened and infiltrated by tumor down to the posterior aspect of the head of the pancreas The duodenum and the head of the pancreas were mobilized by incision of the peritoneum along the greater curvature of the duodenum

4 A wedge of liver about 1 cm beyond the gall bladder was incised to free the latter over its entire extent Traction upon the free gall bladder permitted access to the uninvolved right and left hepatic ducts The freed gall bladder is an excellent tractor to aid in mobilizing a neoplasm involving the upper common bile duct and the lower common hepatic duct

5 The right and left hepatic ducts were transected just below their exit *from* the liver

6 The common duct below the mass in the porta hepatis was transected about 3 cm above its entrance into the duodenum In this patient the common duct was not within the pancreatic tissue but the adjacent portion of the head of the pancreas was incised for removal with the above

7 The gall bladder together with the adherent liver tissue the mass in the porta and the metastatic node was excised It was the impression that a segment of the hepatic artery wall was also resected and that this vessel had been of necessity ligated

8 A rubber T tube was inserted one arm into the right hepatic duct and the other into the lower segment of the common duct A urethral catheter (26 F) was inserted in the left hepatic duct and both tubes were brought out of the abdominal wound The lower end of the common duct could not be brought up to the transected right hepatic duct because of the rigidity of the tissues remaining in the porta hepatis A soft rubber drain was placed in the right kidney fossa

9 The abdominal wound was closed in layers

Convalescence was uneventful The patient was discharged on the twenty fifth day The icteric index which was 128 a day after operation had fallen to 38 Bile was being discharged principally through the T tube and very little came from the urethral catheter in the left hepatic duct

The surgical specimen consisted of thickened shrunken gall bladder over which liver tissue about 1 cm in thickness was densely adherent The fundus of the gall bladder merged into an irregular dense tumor mass In

the latter a segment of the common bile duct, about 5 cm in length containing one stone was present There was also an enlarged, firm lymph node 3×2×2 cm Dense neoplastic tissue surrounded the segment of the common duct and the proximal portion of the gall bladder The whole specimen weighed 56 gm Histologic study of the gall bladder wall and the wall of the common duct showed extensive infiltration by small groups and cords of malignant epithelial cells In the tissues about these structures similar infiltration by neoplastic cells was present The lymph node showed almost complete replacement of lymphoid tissue by carcinoma

Following discharge on July 8 1941 the patient gained strength rapidly and became quite active By August 22 the urethral catheter in the left hepatic duct had come away spontaneously The icteric index had fallen to 13 8 and on this day the extra abdominal portion of the T tube in the right hepatic and lower segment of the common duct was cut just above the level of the skin and clamped after lipiodol injection of the tube under the fluoroscope showed a patent sinus from the right hepatic duct into the duodenum He was readmitted on October 20 1941 because of chills fever, and malaise The icteric index was 7 8 the urine contained many organisms Following sulphathiazole therapy there was rapid improvement and the patient was discharged on the eleventh day

He was admitted for the third time on November 19 1941 for study of the possibility of removing the T tube Bile apparently was draining completely in the tube from the right hepatic duct into the duodenum There was no external biliary drainage about the clamped stump Under observation the stools were of normal color and he otherwise felt well It was finally decided to let well enough alone and the patient was again discharged He had been working part time as an accountant and now pursued these duties full time until April 1942 During the winter of 1941–42 he regained most of the weight lost after the first operation However on April 6 1942 he was readmitted having exhibited icterus of 2 weeks duration Examination of the abdomen was negative The clamped T tube was in place and no bile was discharged about it The icteric index was 74

Operation for relief of recurrent obstructive jaundice was performed on April 19 1942 as follows

PARTIAL RESECTION OF RECURRENT CARCINOMA IN THE PORTA HEPATIS

1 The abdomen was opened through the high right paramedian incision scar and included the stump of the T tube The latter served as a

guide to the porta hepatis Many dense adhesions were encountered in the upper abdomen

2 A carcinomatous mass was encountered in the porta hepatis within it the T tube inserted in June 1942 was found but it was distorted by tumor growth The lower end of the stomach was drawn into the porta hepatis by infiltrating carcinoma There were discrete metastatic tumor nodules in the liver adjacent to the porta The upper margin of the mass was freed by transection of the right hepatic duct at the level of its exit from the liver No gross evidence of the left hepatic duct was observed The left lobe of the liver appeared normal although for 8 months its principal duct the left hepatic duct had apparently been occluded

3 By sharp dissection the major portion of the recurrent carcinoma was excised Distally the lower end of the common duct infiltrated by tumor up to its entrance into the duodenum was also resected and the stump ligated

4 The pylorus was resected in the usual manner the upper end of the stomach closed and a Billroth II gastrojejunostomy performed

5 A vitallium tube was inserted into the right hepatic duct and the lower end was inserted into an opening made in the duodenum about 8 cm distal to the invaginated stump and secured with a purse string suture Interrupted sutures were then inserted between the duodenal serosa and the right hepatic duct stump (about the vitallium tube)

6 The abdomen was closed with a soft rubber drain to the right kidney fossa

Immediate convalescence was relatively satisfactory although bouts of chills and fever occurred at irregular intervals for 3 weeks The patient was discharged on the forty second day after operation having had normal temperature for 17 days The icteric index had fallen to 30 at the time of discharge He died suddenly at home 2 weeks after leaving the hospital—8 weeks after the last operation necropsy was not obtained

The features of interest presented by this patient are the palliative results which permitted almost a year of survival in comfort and with a period of return to normal activities free from icterus for 5 months Of interest also is the fact that the left hepatic duct may be occluded (removed) without apparent disturbances owing in all probability to free bileduct anastomoses between the left and the right hepatic lobes

A similar operation was performed in the following patient

Case 32 —M Wal (321201) female 60 years of age Entered the hospital on November 4 1943 complaining of icterus of 7 weeks duration and loss of 10 pounds in weight during this period There was no abdominal pain Physical examination revealed a deep palpable *mass in the right upper quadrant* thought to be distended gall bladder The icteric index was 89 5 and 4 days later it was 115 Gastroduodenal fluoroscopy was negative The stools were acholic The clinical diagnosis was carcinoma of the ampulla of Vater or head of the pancreas and operation was performed on November 11 1943 as follows

CHOLECYSTO CHOLEANGIO CHOLEDOCHECTOMY (FIG 88)

1 A high mid line incision was made extending to below the umbilicus

2 The gall bladder was not markedly distended and the mass palpated prior to operation proved to be the lower border of the right lobe of the liver The gall bladder, however, was thickened mottled rigid and filled with inspissated material and stones

3 Palpation of the head of the pancreas and of the ampullary region was negative This was repeated after the peritoneum along the convex border of the duodenum had been incised and the head of the pancreas and the duodenum had been elevated The lower segment of the common bile duct was negative The liver exhibited no metastases

4 Palpation in the region of the common hepatic duct revealed a hard mass of indefinite borders that extended up to the liver and also involved the cystic duct and the upper common bile duct It was decided to resect the mass

5 The fundus of the gall bladder was opened and its inspissated contents with stones were evacuated The gall bladder was *then freed from* the undersurface of the liver and it was used as a tractor for the mass in the porta hepatis The cystic duct seemed *to enter the mass*

6 The common bile duct was transected in its lower segment behind the duodenum and separated from the portal vein The hepatic artery was palpated and its lower segments were found to be free of invasion by the tumor *A large lymph node* 3×2 cm, was removed from the anterior aspect of the upper portion of the common bile duct

7 Traction was exerted on the upper segment of the common duct Dissection was carried upward and the mass was freed from the underlying portal vein up to the liver Transection of what appeared to be stumps of the right and left hepatic ducts at their emergence from the liver was carried out and white ' bile escaped from the latter All the mass with attached gall bladder and common duct was freed except at one point which appeared to be the posterior aspect of the upper portion of the com

mon hepatic duct as dissection was completed to free this a large gush of blood occurred This was arrested by application of three Kocher clamps A tear had been made in the upper right border of the portal vein or its right branch Attempts to suture produced more hemorrhage the vein wall was rigid but friable and was obviously invaded by tumor

The three Kocher hemostats were then reapplied to the tear and left in place their handles protruding from the wound

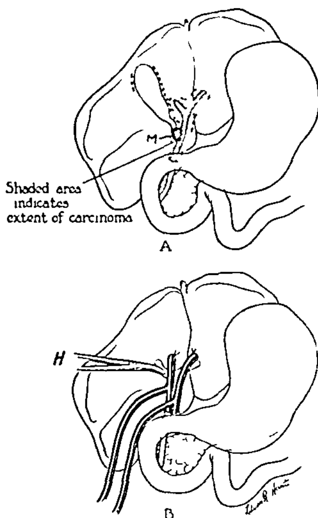


FIG 88 —Case 32 (391201) Diagram illustrating A carcinoma involving right and left hepatic ducts common hepatic and upper common bile ducts with M metastatic node B after resection (cholecystocholangio-choledochectomy) T tubes were placed in each hepatic duct within liver and together in stump of common duct hemostat H was placed upon right branch of portal vein because of accidental tear (actually three hemostats were placed here) these were removed on third day without hemorrhage Survival with palliative results (see text)

8 One T-tube was inserted into the sinus in the liver that appeared to be the right hepatic duct and the other arm into the stump of the common duct A second T-tube of smaller caliber was inserted into the left hepatic duct and the other arm also into the stump of the common duct beside the arm from the tube in the right hepatic duct Since there was no duct wall extending below the liver tissue the tubes could not be tied into place in the hepatic ducts On the other hand, they were secured in the stump of the lower common bile duct by a linen ligature The presence of the hemostats on the portal vein precluded hepatoduodenostomy which would have been attempted had these hemostats not been present

9 The abdomen was closed with soft-rubber drains to the porta hepatis the right kidney fossa and the liver bed of the gall bladder The three hemostats placed on the injured portal vein also protruded from the wound as mentioned above, as well as the long arms of both T tubes

Histologic study of the specimen which consisted of the gall bladder measuring 9 cm in length, and the attached segments of the lower common hepatic and upper common bile ducts (Fig 89), revealed the entire gall bladder wall to be infiltrated by nests of carcinoma cells The attached segments of resected common hepatic and common bile ducts were also infiltrated by tumor cells The three hemostats clamped to the right branch of the portal vein were removed on the third day there was no hemorrhage

Convalescence was essentially uneventful Two weeks after operation lipiodol injections of the T tubes revealed patency into the duodenum and into the large intra hepatic bile ducts By the end of the sixth week after operation the icteric index had fallen to 37 (preoperative 82.5) Bile drained freely out of the abdominal wound about the tubes through the tubes and some into the duodenum (as observed from the color of the stools) The patient was retained in the hospital for 82 days for metabolic studies After discharge she continued to be comfortable had no abdominal pain but only a fair appetite Asthenia was rapidly progressive and icterus did not clear entirely She expired at home on February 27 1944, 3½ months after operation necropsy was not obtained

As mentioned above the exact limits of malignant neoplasms situated in the porta and arising from the extra hepatic bile ducts cannot always be ascertained and, as excision by sharp dissection progresses the hepatic artery may be severed and ligated This occurred in 2 patients operated upon by the writer and described below In each instance there was a fatal



Fig. 89.—Case 92 (321201). Surgical specimens showing *Gb*, gall bladder infiltrated by carcinoma primary (?) in common hepatic duct *T*. The metal probe is in the termination of the cystic duct. *CC*, common hepatic and upper portions of common bile duct, the walls of which are rigid and infiltrated by carcinoma. *I*, large metastatic lymph node removed from anterior aspect of upper portion of common duct. *D*, inspissated material and concretions removed from gall bladder.

outcome, one immediate and the other delayed for 10 days The histories and operative procedures are as follows

Case 51 —Prol (302751) male 59 years old *Entered the hospital on February 13* 1943 complaining of severe icterus of 5 months duration and loss of 70 pounds in weight during this period There was no abdominal pain General physical examination was negative except for the severe icterus (icteric index 121)

The clinical diagnosis was carcinoma of the ampulla or head of the pancreas and laparotomy was performed on February 20 1943, as follows

CHOLEDOCHO CHOLEANGIO CHOLECYSTECTOMY

1 A high right paramedian incision was made

2 The gall bladder was not distended and the common bile duct not enlarged Palpation of the head of the pancreas and the lower common bile duct revealed no evidence of tumor The peritoneum along the convex border of the duodenum was incised and the head of the pancreas mobilized Palpation through the duodenal wall revealed no tumor mass in the region of the ampulla There were no hepatic metastases

3 Palpation of the upper common bile duct cystic duct and lower common hepatic ducts revealed a very hard mass involving these structures and apparently extending upward into the hilum of the liver The mass appeared to be about 3 cm in diameter

4 The common bile duct was transected below the mass A hemostat was applied to the upper segment and traction was exerted upward

5 An attempt was then made to dissect free the mass which involved the confluence of the cystic and common hepatic ducts During this process the portal vein was opened by a linear tear about 1 5 cm in length Hemostats were applied one after the other in linear fashion four in all closing the tear while the portal vein itself was compressed into a flat band by the left index finger beneath it

Interrupted silk sutures were placed just beyond the tip of each hemostat and as the first knot was tied the hemostat was removed By this procedure the portal vein was successfully closed

6 Dissection was resumed and because of the infiltrative nature of the neoplasm it was again difficult to identify the structures encountered A large artery was cut and promptly secured with hemostats and ligated It was felt that this was the hepatic artery

7 Dissection was continued upward to the hilum of the liver and carried into the liver itself about the hard mass that evidently involved

both right and left hepatic ducts When the mass was removed a gaping space interpreted as the right hepatic duct was revealed there was a discharge of white bile from it The left hepatic duct could not be identified

8 Inasmuch as the patient had lost considerable blood when the portal vein was entered and although his condition at this stage was satisfactory it was decided to terminate the operation as rapidly as possible According



Fig 90 —Case 31 (302751) Surgical specimen consisting of entire gall bladder and carcinomatous mass T involving termination of cystic duct upper common and lower common hepatic duct Segment of hepatic artery A included in resected specimen Patient survived operation only 17 hours (see text) Necropsy showed massive infarction of liver

ingly the tumor mass and gall bladder were peeled backward from the liver and removed

9 A large urethral catheter was inserted into the right hepatic duct stump and sutured to the fascia of the abdominal wound margin The lower segment of the common duct was ligated A soft rubber drain was inserted into the right kidney fossa and the wound was closed in layers

The patient s condition immediately after operation was satisfactory However 12 hours after operation evidence of shock developed and this progressed rapidly to death 17 hours after operation

Study of the surgical specimen (Fig 90) showed it to consist of the gall-bladder the walls of which were thick and rigid Neoplastic infiltration

had obliterated the cystic and common hepatic ducts *It was not possible* to ascertain whether the tumor arose from the hepatic or the cystic ducts Within the *tumor* mass there was a segment of hepatic artery which did not appear markedly constricted by the tumor Histologic study revealed carcinoma

Necropsy revealed about 600 cc of sanguineous fluid within the peritoneal cavity There was no apparent site of bleeding and this may have *remained from the operation The whole right lobe of the liver was infarcted* the ligation of the hepatic artery some 7 cm from its origin was *confirmed* The repair in the portal vein was tight There were no antemortem *clots* in the portal circulation above the site of repair in the portal *vein* Death resulted from occlusion of the hepatic artery (additional discussion of the surgery of the vessels in this region is given in chap xv)

Microscopic study showed nests of carcinoma cells in the tissues of the *porta hepatis*

The following patient presented a carcinoma of the cystic duct which according to Stewart Lieber and Morgan is a very rare site for primary neoplasms since in a critical review of 27 case reports in the literature they were unable to consider any of these cases as indisputable instances of primary carcinoma of the cystic duct

Case 52 —Smol (950119) white male 63 years of age Admitted on October 6 1940 *complaining of soreness and heaviness in the stomach icterus and generalized pruritus* of 3 weeks duration There had been loss of 20 pounds in weight The icteric index was 115 Palpation of the abdomen was negative Gastroduodenal fluoroscopy revealed no abnormalities

Laparotomy was performed on October 18 1940 as follows

CHOLEDOCHO CHOLEANGIO CHOLECYSTECTOMY

1 A high mid line incision was made

2 *General exploration was negative* except *for a rounded* hard mass 3 cm in diameter palpated in the region of the confluence of the cystic and the common hepatic ducts The gall bladder was not markedly distended

3 The fundus of the gall bladder was dissected *from the liver bed* and the freed gall bladder was used to exert traction on the mass The common hepatic duct above the latter was markedly dilated the common bile duct below it was contracted

4 The common hepatic duct was transected about 0 5 cm above the mass and the common bile duct transected below it

5 The mass was dissected from the anterior aspect of the portal vein, and in its final dissection the hepatic artery was inadvertently transected and ligated This artery had coursed within the tumor mass

6 The contracted portion of the common duct was slit on its anterior aspect thus permitting widening of its upper portion for anastomosis over a T tube with the dilated common hepatic duct, as shown in Figure 91

The peritoneum along the greater curvature of the duodenum was incised to permit mobilization upward of the lower portion of the common bile duct in order to effect the above anastomosis

7 The abdomen was closed with a soft rubber drain to the right kidney fossa

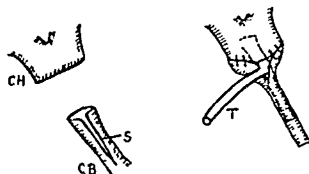


Fig 91 – Case 52 (250119) Showing method of approximation of *CH* dilated common hepatic duct and *CB* contracted common bile duct after resection of carcinoma The common bile duct has been split on anterior surface S which permits spread of upper end for anastomosis over (*T*) T tube

Study of the surgical specimen (Fig 92) revealed the tumor completely occluding the cystic duct and extending backward toward the gall bladder to dilate the proximal orifice of this duct at the junction with the gall-bladder The excised upper portion of the common bile and common hepatic ducts were also invaded by the tumor The segment of hepatic artery was identified within the tumor mass Microscopic sections showed adenocarcinoma The walls of the gall bladder were also infiltrated by carcinoma cells

The immediate postoperative course was satisfactory Biliary drainage from the T tube varied from 300 to 1 000 cc a day The icteric index increased during the first 3 days to 200 Appetite returned and by the end of a week the patient was eating very well By the nineteenth day it appeared that most of the bile was being discharged about the tube and the latter was removed On the twentieth day there was discomfort in the upper abdomen and the patient exhibited a drawn expression The next day





Fig 92 —Case 52 (250119) A resected gall bladder with C carcinoma at cystic duct pushing backward into lumen of gall bladder and distending orifice of cystic duct B reverse view of specimen showing C carcinomatous mass arising in cystic duct and infiltrating wall of CH common hepatic duct and CB common bile duct The mass included a segment of hepatic artery the orifice of which is shown at A Patient survived 22 days and died of acute hepatic insufficiency Necropsy showed infarcts in liver

he vomited on several occasions the icteric index had fallen to 62, the lowest since admission He died suddenly on the evening of the twenty second day The plasma proteins exhibited the following variations day before operation 6 59 gm per cent fourth postoperative day 5 91 gm per cent 2 days before death 4 1 gm per cent

Necropsy revealed the following there was no peritonitis or hemorrhage on the anterior margin of the right lobe of the liver there was a wedge shaped infarct pointing toward the porta the base measuring 8×4 cm a similar area 3 cm in diameter was present in the posterior margin of the right lobe The hepatic common duct anastomosis was tight except at the point of exit of the T tube The pancreas was normal Eight millimeters distal to the pyloric sphincter in the duodenum there was an ulcer but there was no evidence of hemorrhage from this No metastases were present in the liver

Histologic study revealed the beginning organization of the infarcted areas There were nests of carcinoma cells in the areolar tissues of the porta hepatis and in the gall bladder bed

The relatively small size of the infarcts can hardly account for the patient's death However the marked reduction in plasma proteins observed during the 3 week period of survival indicates hepatic failure which was undoubtedly the result of suppression of the circulation derived from the hepatic artery—a deficiency that was not immediately fatal but one that could not be finally compensated

An unusual instance of carcinoma of the common bile duct is afforded by the following patient in that a period of improvement for several months followed simple biopsy of the lesion

Case [illegible] —C ah (3[illegible]441) white female [illegible] years of age In January 1913 the patient had developed icterus accompanied by severe backache In February 1913 an exploratory laparotomy had been performed in another institution at which time stones were found in the gall bladder and a firm induration was discovered at the confluence of the cystic with the common hepatic duct Biopsy of this area was taken and reported as showing carcinoma Cholecystostomy was performed In 2 months the icterus had disappeared and the cholecystostomy closed spontaneously without recurrence of jaundice The general condition remained relatively satisfactory except for occasional pain in the epigastrium following meals Nine x ray treatments were given to the epigastrium but this did not relieve the pains During the summer and fall of 1913 she remained free from icterus The patient was admitted to the hospital on February 5 1914 complaining of increasing icterus of 3 weeks duration severe pruritis epigastric pain more severe than previously and loss of appetite Physical examination was negative except for emaciation icterus (icteric index 51 4) excoriations over the arms and abdomen (from scratching)

and some tenderness in the upper abdomen Roentgenographic study of the stomach and duodenum showed no abnormalities and cholecystograms showed nonvisualization of the gall bladder

The prothrombin which was 74 per cent was elevated to 100 per cent as a result of vitamin K administration The sections of the biopsy previously made were reviewed and the diagnosis of carcinoma confirmed

Laparotomy was performed on February 14 1944 as follows

CHOLEANGIO CHOLEDOCHO CHOLECYSTECTOMY (AND ENTERECTOMY WITH ENTEROENTEROSTOMY)

1 The abdomen was entered through a high mid line incision

2 Dense adhesions were encountered beneath the old scar, and one loop of the jejunum was so firmly adherent to the under surface of the anterior abdominal wall that it was accidentally opened The wall of the bowel was so thin in this region that a whole segment 5 cm long was resected, with end to end anastomosis

3 Dense adhesions were divided in the upper abdomen to exposure of the gall bladder whose walls were found to be quite firm and thickened No stones were palpated

4 In the region of the confluence of the cystic and the common hepatic ducts a firm nodulosity was palpated

5 The peritoneum over the convex margin of the duodenum was incised and mobilization of the duodenum and the head of the pancreas was attempted Because of dense adhesions over the anterior aspect of the head of the pancreas, this could not be accomplished

6 The lower portion of the common bile duct was identified and found to be contracted its walls being rigid The common bile duct was transected posterior to the head of the pancreas A probe was passed into it to the duodenum encountering no obstruction

7 The upper segment of the common bile duct was elevated and found to have become contracted into a dense fibrous cord—a solid cord of carcinomatous tissue

8 The gall bladder was resected after division of the dense mass about the cystic duct

9 As much tissue as possible was removed from the porta hepatis in the region that was thought to have been the common bile duct

10 A bulging cystic structure was then encountered in the porta adjacent to the liver and when aspirated yielded light green bile This was opened by a transverse incision 1½ cm in length and more bile was aspirated It represented the confluence of the right and left hepatic ducts just outside the liver The walls were very rigid and obviously infiltrated

11 It was deemed inadvisable to perform hepatoduodenostomy with carcinoma present in the porta. The small segment of the lower common bile duct was ligated.

12 There were no hepatic metastases visible or palpable. A large urethral catheter was inserted into the opened stump of the common hepatic duct and sutured in place. A soft rubber drain was placed in the right kidney fossa and the abdominal wound was closed in layers.

Microscopic study of the walls of the gall bladder and of the tissue removed from the porta hepatis revealed extensive infiltration by small nests and cords of carcinoma cells.

The postoperative course was essentially uneventful. Bile drainage from the tube in the common hepatic duct did not occur for some days but finally did take place. The icteric index did not fall appreciably during the postoperative period. The patient was discharged on the forty second postoperative day. Subjectively she was improved; the appetite was fair and there was little abdominal pain. Bile drainage was copious. After returning home the tube in the stump of common bile duct came away spontaneously but bile continued to drain from the sinus. Bile salts were given by mouth. A report from the patient (who lived in another city) on June 9, 1944 stated that she "was holding her own"; her appetite was fair, icterus had cleared and she was up and about most of the day. There was no pain. By the first week in July 1944 marked asthenia had developed; she was admitted to a hospital in another city and expired 5 months after the last operation described above.

In the series of 7 patients (including Case 72 of carcinoma of the common hepatic duct described in chap. xv) with advanced cancer of the hepatic ducts, gall bladder and upper common bile duct, 3 survived the operation for 17 hours, 7 days and 22 days respectively—all dying as a result of ligation of the hepatic artery. Injury to this vessel is the major hazard in attempting resection of advanced carcinomas of this type. One (Case 85 [348567]) survived 9 days, dying of exhaustion. Two patients survived 3½ and 5 months respectively, with improvement in the major sign, jaundice. One survived a year with return to full normal activities for 5 months and with freedom from jaundice for most of the survival period. It is believed that the latter result would not have obtained if only a tube had been inserted in the right hepatic duct. The radical operations described above are justified in attempts to achieve results equal to, or perhaps better than, the one last mentioned.

CHAPTER XV

INJURIES TO THE HEPATIC ARTERY, PORTAL VEIN, AND SUPERIOR MESENTERIC VESSELS

FOLLOWING the discussion of operative procedures about the superior mesenteric vessels and in the porta hepatis, a consideration of the problems presented by injuries to the large vessels in this region is in order, since such complications occur during attempted resection of malignant tumors in this area.

HEPATIC ARTERY

A review of the cases of accidental ligation of the hepatic artery recorded up to 1933 was reported by R. R. Graham and Cannell, who added 1 case of their own to a series of 27. The following principles were emphasized: (1) Ligation of the common hepatic artery may be carried out without impairment of hepatic nutrition. (2) Ligation of the arteria hepatica propria before the right gastric artery is given off usually results in no ill effects. (3) Ligation beyond this point is attended with severe to total necrosis of the liver where the artery has previously been healthy. The existence of previous arterial disease, anomalies, and the establishment of efficient collateral circulation permit success of the latter ligation in some instances.

Ligation of the hepatic artery or its branches is never an elective procedure (unless there is an aneurysm of it) but is, of necessity, performed when these vessels are injured accidentally. In carcinomas of the bile ducts or gallbladder, where the porta hepatis is infiltrated by tumor and where excision of the latter is carried out by sharp dissection, there is great danger of injury to the hepatic artery or its branches. Palpation for pulsations should aid the surgeon in localizing the vessels, although if they are surrounded by tumor the pulsations may not be detected. Theoretically, gradual reduction in the size of the vessel by compression of surrounding tumor tissue should favor the development of collateral arterial circulation and should lessen the dangers of ligation of the hepatic artery. Actually, in the author's experience in 2 patients, in whom the hepatic artery, before it divided into its right and left branches, was surrounded and ap-

parently compressed by tumor tissue and the involved arterial segments were excised with the tumor death resulted in 17 hours and in 22 days respectively with necropsy findings in the former of extensive infarction of the right lobe and with smaller areas of infarction of the left lobe in the latter In the series of 28 cases reported by Graham and Cannel and mentioned previously death resulted in 16 of the patients in whom the hepatic artery or its branches were ligated The importance of the resulting liver necrosis in these deaths is not easily determined For the most part they occurred in patients suffering from other diseases and frequently accompanied extensive intra abdominal operations In at least 7 instances death was attributed to liver insufficiency However the extensive liver necrosis which may occur without fatalities encourages one should ligation of the artery become necessary or occur accidentally during an operation Gradual occlusion of the hepatic artery in dogs was successfully carried out by Huggins and Post

The following patient is cited to illustrate an unusually long survival following 7 days occlusion of the portal vein and the hepatic artery

Case 72 —Col (28 731) white male 59 years of age Admitted on May 29 1942 because of increasing icterus loss of 35 pounds in weight and steatorrhea for 5 months No abdominal pain Physical examination was negative except for icterus (icteric index 102) Laparotomy was performed June 3 1942

CHOLECYSTO-CHOLEANGIO-CHOLEDOCHECTOMY

Exploration revealed no evidence of carcinomatosis The liver was free from metastases The walls of the right and left and common hepatic ducts were rigid and shrunken owing obviously to infiltration by neoplasm primary in this region The gall bladder was shrunken and its walls flaccid It was freed except for the cystic duct Traction upon it failed to mobilize the indurated hepatic ducts Cholecystectomy was performed The common bile duct was transected a short distance below the cystic duct stump and with traction on its upper segment dissection of the indurated hepatic ducts was undertaken They were transected at their emergence from the liver and then were completely mobilized except for adhesions on their posterior aspects Dissection with scalpel was begun to free them for removal suddenly a copious hemorrhage developed and very much blood was lost before the hemorrhage was arrested The hemorrhage obscured the field Arrest of the hemorrhage was brought about by application of numerous hemostats blindly into the porta hepatis Because the patient s condition was poor these clamps (ten in number) were

left in place A urethral catheter was inserted into the sinus in the liver, which was interpreted to be the left hepatic duct, and was brought out through the wound The right and left hepatic, common hepatic and upper common bile ducts were removed A gauze pack was inserted about the shanks of the hemostats and the lower portion of the high mid line abdominal wound was closed in layers The hemostats and gauze pack protruded from the open upper half of the wound

Sections of the hepatic ducts revealed infiltration by carcinoma The gall-bladder wall did not contain carcinoma

The patient's condition after operation was satisfactory There was copious biliary drainage The highest temperature on the second and third days was 101° F (oral) All hemostats were removed from the wound on the fourth day without hemorrhage The temperature rose briefly to 104° (rectal) on this day, but his condition remained satisfactory On the fifth day the temperature was normal on the sixth day it rose to 101° F (rectal) He did not respond well to questions On the seventh day he became comatose and expired, the temperature having risen to 103° F (rectal) before death The urine output had averaged 600–800 cc a day

Necropsy revealed the following massive septic infarction of the liver trauma and thrombosis of the portal vein and the hepatic artery acute passive congestion of the spleen and thrombosis of the splenic vein bilateral pulmonary edema and hydrothorax No gross evidence of residual carcinoma was present

Quoting verbatim from the autopsy protocol "The area around the porta hepatis is bloody and distorted However, it can be seen that both the portal vein and the hepatic artery have been clamped off at one time for there are hemostat marks on each vessel"

In the writer's opinion resection of a neoplastic process in the porta hepatis might be undertaken for palliative purposes even though the hepatic artery may appear to be involved the latter may be dissected free from the tumor in order to accomplish the excision In one patient (Case 18 see chap xix) with carcinoma of the extra hepatic bile ducts where it was felt that a partially obliterated hepatic artery was resected with the tumor there was excellent palliation for a year following the operation Unfortunately necropsy was not obtained when the patient died and final confirmation of the resection of this artery was not possible The danger of ligating this vessel however did not deter excision of the growth

PORTAL VEIN

Gradual occlusion of the portal vein is not incompatible with life, as shown by numerous case records reported in the literature of progressive portal thrombosis. In Brewer's patient, gradual occlusion of the portal vein occurred by pressure from a progressively expanding echinococcus cyst in the liver beneath it. The portal vein had been compressed to a flat bandlike structure and during the operation for excision of the cyst the vein was accidentally opened, necessitating ligature of it below the site of compression. The patient survived and there was no evidence of disturbances due to this procedure.

Sudden complete ligation of the portal vein when it had not previously been compressed is apparently always fatal and, of course, is never performed as an elective procedure. In dogs, ligation of the portal vein is fatal in $\frac{3}{4}$–$2\frac{1}{2}$ hours (see review by Cole and Elman). In one patient in this series (Case 2), where such a ligation had to be carried out to prevent immediate fatal hemorrhage, there was survival for only 3 hours. Since, however, there are anastomoses between the veins at the root of the mesentery and those in the retroperitoneal spaces and also in the spaces of Retzius, as well as additional ones that may result from adhesions of the omentum to the anterior parietal peritoneum, ligation of the portal vein may not always be rapidly fatal, as in the following instance.

Case 56.—Dar (170440), female, 47 years of age. Admitted to the hospital because of icterus of 4 weeks' duration and 25 pounds weight loss in 5 weeks. The clinical impression was carcinoma of the head of the pancreas.

At laparotomy a rounded hard mass, about 4 cm. in diameter, was palpated in the neck of the pancreas and extended to the anterior aspect of the portal vein at its origin. It was the initial impression that it could be resected by pancreatoduodenectomy with transection of the pancreas distal to the tumor. The stomach was transected proximal to the pylorus. The duodenum and the head of the pancreas were mobilized and elevated to the left. It was evident that the tumor had infiltrated the first segment of the portal vein and the terminal portion of the superior mesenteric vein. An attempt was made to dissect the tumor free, but the portal and superior mesenteric veins were opened with sudden copious hemorrhage. Considerable difficulty was encountered in arresting the hemorrhage. This, however, was finally accomplished only after ligation of the superior mesenteric vein and clamping of the first portion of the portal vein. There was complete division of the portal vein near its origin. Attempts to

anastomose the superior mesenteric vein and the portal vein were futile as the distance between them was too great and the walls tore apart when approximation was attempted The operation was completed rapidly by bisection of the tumor, leaving the distal portion in situ The duodenum and the head of the pancreas were resected Gastrojejunostomy was performed, and, since rapid fatality was expected, choledochojejunostomy was not performed, instead, a urethral catheter was inserted into the common duct and brought out through the abdominal wound In the closure of the latter it was observed that there were numerous and dense adhesions of the omentum to the lower abdominal wall as a result of a gynecologic operation several years previously through a low mid line incision

Immediate recovery from the operation occurred There was no evidence of shock, and urinary output of about 2,000 cc a day was noted On the sixth day the temperature rose to 101° F (rectal), on the seventh day it rose to 102° F on the eighth and ninth days it ranged between 103° and 104° F On the latter day the blood pressure fell to 75/65 and plasma and blood transfusions were given, the plasma proteins were 4 8 gm per cent The patient expired on the tenth day

Necropsy (Fig 93) revealed bile peritonitis from leakage about the catheter to the common duct and the gastrojejunostomy was sealed There were acute shallow ulcerations in the mucosa of the stomach Histologic study revealed extensive degenerative changes in the liver Half of the neoplasm (carcinoma) was in situ in the proximal portion of the body of the pancreas

The immediate survival and death 10 days later, presumably from peritonitis raises the question of whether the hepatic changes might not have been due to the peritonitis Immediate survival was the result of the anastomoses of the large veins in the omentum with those of the anterior abdominal wall resulting from the gynecologic operation years previously there were also large dilated veins in the base of the mesentery of the small bowel which anastomosed with the retroperitoneal branches of the inferior vena cava

The experience afforded by this patient suggests that if a collateral circulation is developed as might be the case if extensive adhesions are present between the omentum and the anterior parietal peritoneum ligation of the portal vein might be successful such ligation permitting excision of a carcinoma of the head and neck of the pancreas that had infiltrated the first portions of the portal vein and that otherwise might be operable



Fig 93 —Case 58 (170446) Necropsy specimen of patient in whom portal vein was accidentally divided and ligated and who lived 10 days and died of bile peritonitis Survival was possible because of collateral circulation at base of mesentery of small bowel and dense vascular adhesions between omentum and anterior abdominal wall (see text for full details) *S* ligated superior mesenteric vein *P* ligated portal vein *N* residual carcinoma in neck of pancreas *pan* body of pancreas

This led the writer, in conjunction with *Bigelow* and *Nichols* to undertake a series of experiments in dogs the object of which was to devise a relatively simple method for gradual occlusion of the portal vein that might have clinical application. It has long been known that total ligation of the portal vein in normal dogs is invariably fatal in $\frac{3}{4}$–$2\frac{1}{2}$ hours, but that, if stage ligation is performed, the animals survive (see review

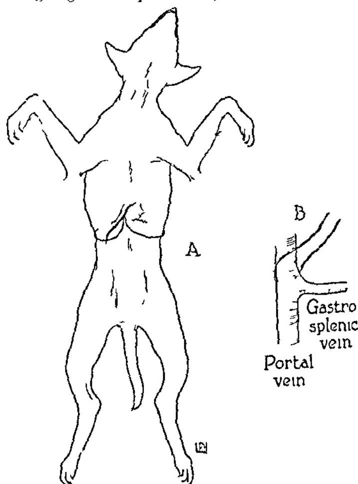


Fig 94.—Illustrating a method of bringing long ends of ligature that has been placed about portal vein as shown in *B* out of the abdominal wound. Long ends tied over the back of the dog (see text)

of question by Neuhof). By the latter is meant the application of a ligature first which constricts the lumen to half its size, several days later to three fourths, etc until complete ligation is obtained. It has also been repeatedly demonstrated that if the principal tributaries to the portal vein are each ligated at successive operations final occlusion of the portal vein with survival is possible. In man however several laparotomies for stage occlusion of the portal vein prior to excision of carcinoma of the head and neck of the pancreas is hardly feasible.

As early as 1856 Oré demonstrated that if a ligature is passed but not tied about the portal vein in dogs and the long ends brought out of the abdominal wound and tied over the back an inflammatory reaction is set up which results in gradual thrombosis of the portal vein with survival of the animal. Oré stated that after a few days the ligature could be cut and pulled out of the abdomen.

In a series of experiments upon dogs it was observed that if, under aseptic conditions, a linen ligature is simply passed about the portal vein, the long ends brought out through the abdominal wound and tied over the dog's back, and that if the ends be pulled up firmly on successive days beginning the fourth to sixth day after operation, the intact loop may be pulled out of the abdomen by the tenth to the fourteenth day (Figs. 94, 95 and 96). This indicates that the portal vein has been traversed by the ligature. After the linen loop had been recovered the animals survived and were sacrificed at intervals of several weeks. In some instances the portal veins were found constricted but patent at the site of the loop—indications of the level of transection of the portal vein were present in the form of small ridges in the lining of the vessels. In others the portal vein had been completely occluded. Laparotomy was performed in three animals after the loop had been pulled out of the wound (Figs. 97 and 98) and the markedly constricted or occluded segments of portal vein were excised with survival of the animal.

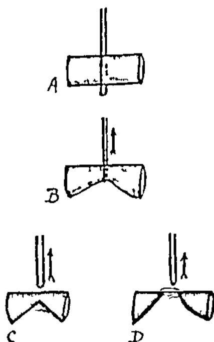


Fig. 95.—Illustrating mechanism of action of transecting ligature placed about portal vein. *B*, upward pressure temporarily constricts vein. *C*, ligature has transected vein but patency of lumen persists or is re-established; or *D*, after transection by ligature portal vein remains occluded.

Studies were also carried out to determine whether or not wide attachment of the omentum to the anterior parietal peritoneum would afford the development of a collateral circulation that would permit of survival following occlusion of the portal vein. The results were negative because in the dog adhesions thus produced are essentially fibrous and relatively avascular.

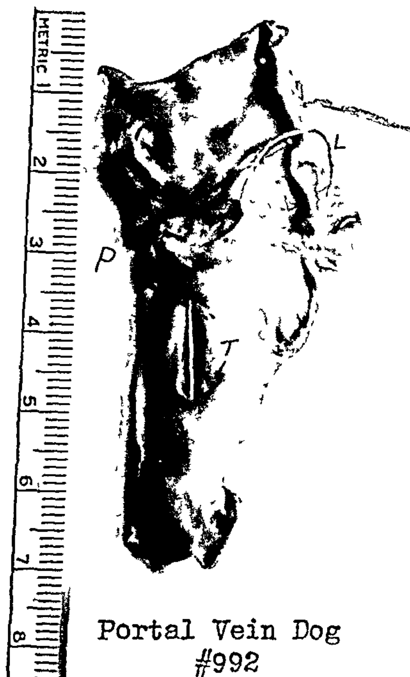


Fig. 96.—Photograph of necropsy specimen of dog to illustrate mechanism of transection of portal vein by a loop of thread passed about portal vein but not tied. Ends of ligature are left long and brought out through wound. These ends are pulled upon at intervals. Illustration shows *L*, loop having transected half of *P*, portal vein; metal probe *T* in orifice of gastrosplenic vein which enters beginning of portal vein.

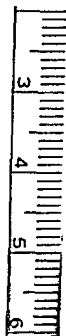
At this writing, the opportunity to attempt the above procedure in man has not presented itself.

Injuries to the portal vein may be repaired by suture (as described below *in connection with the superior mesenteric vein*) while the vessel is compressed by the finger passed beneath it and pressed upward. On one occasion the writer, while dissecting away a carcinoma of the hepatic ducts, opened the right branch of the portal vein just prior to its entrance into the liver. Attempts to suture the rent failed because of the friability



Fig 97.—Experimental elective occlusion and then successful resection of portal vein. Necropsy specimen of Dog 230 showing *PE*, site of excised portal vein; *RP* and *LP*, right and left branches of portal vein, respectively; *S*, terminal segment of superior mesenteric vein. The portal vein was excised after previous ligature occlusion (see text) and animal survived for 13 days in good condition. It was then sacrificed to confirm the fact that the portal vein had been excised.

of the vessel wall due to tumor infiltration Three Kocher hemostats were applied serially to close the wound in the vessel wall and were left in place the abdominal wound being closed except for the protruding hemostats Three days later they were removed and there was no hemorrhage convalescence continued uneventfully (Case 32) This procedure while not an elegant one has been reported from time to time for many years as a measure to deal successfully with wounds in large deep veins where repair by suture was not feasible





Portal Vein Dog
#230

FIG 98—Showing segment of portal vein resected from Dog 230 the necropsy findings of which are shown in Figure 97

Successful suture of the portal vein was recently reported by W W Babcock during which procedure this vein and the hepatic artery were temporarily occluded This author cites 5 other instances of surgical closure of wounds of the portal vein recorded in the literature Of special importance in connection with repair of the portal vein is the period during which sudden occlusion may be well tolerated by the patient while the repair is effected In one of Babcock s patients the occlusion lasted for 18 minutes in a second patient it lasted for over 2 hours and there was immediate operative recovery although death resulted on the fifth day Necropsy revealed neoplastic tissue and clotted blood in the portal vein The operation had been performed for excision of a large neoplasm in the left lobe of the liver

Of the other cases cited by Babcock, Hallopeau's patient apparently survived a bullet wound 6.7 mm. in length on the anterior surface of the portal vein which was repaired by suture. Giorgi's patient had a similar wound on the internal surface which was also sutured; death occurred 2 months later of pyonephritis. Schulte's patient cited by Giorgi survived 4 days after direct suture of the vein, and necropsy revealed the wound to have remained closed. *In Roman's patient the wound was tamponaded* 23 hours after injury by a shell fragment, and two artery forceps were also placed on the vein. The gauze plug was removed on the second day, and the forceps on the third day. Death occurred from secondary hemorrhage from the right renal artery on the eighth day.

Steindl's patient survived 11 months after circular suture of the completely divided portal vein carried out with paraffinized silk. Death resulted from suppurative cholangitis and hepatic abscess. Necropsy revealed portal thrombosis, which, from the patient's clinical history, was thought to have started at least on the ninth postoperative day. This author attributes the thrombosis to the clamps which were applied to the vein during repair and recommends the use of only digital pressure to occlude the vein while it is being sutured.

SUPERIOR MESENTERIC VESSELS

Not infrequently carcinomas of the pancreas or of the lower segments of the common bile duct are found closely applied to the superior mesenteric vein and artery. Where the adhesion is essentially inflammatory, separation of the tumor from the vessels may be readily accomplished by sharp dissection. Where there has been neoplastic invasion of the vessel walls, separation is more difficult, and tumor cells are left in the walls. Unfortunately, it is not always possible to ascertain before dissection begins whether the tumor has invaded the vessel wall or is only intimately apposed to it; dissection is begun, and sudden massive hemorrhage occurs from accidental opening of the large vessel. The recorded experiences in such situations are few indeed, and possibly because of the usual fatal termination and the implications that the operator exceeded justifiable boldness, surgeons have not reported these experiences.

The writer in performing pancreatoduodenectomy has on occasion accidentally opened the superior mesenteric vein while separating the neck of the pancreas from its anterior aspect. Short and relatively wide thin-walled veins may enter the superior mesenteric vein from the neck and

head of the pancreas as it courses beneath the former They are so short that exposure and application of clamps is not possible, and sudden copious hemorrhage is the first indication of the accident This hemorrhage may be controlled by insertion of the left index finger into the foramen of Winslow and extending pressure upward (Fig 99) This maneuver collapses the superior mesenteric vein, and after blood is sponged away the opening in the vein is observed Small straight hemostats are applied one below the other, the length of the opening A suture of fine silk is inserted just beneath the tip of the upper hemostat the latter is removed and the suture is tied The operation is repeated for each hemostat until the injury is completely repaired The compressing left index finger is removed and the superior mesenteric vein then fills with blood Leakage would denote the site of incomplete closure which may then be repaired by an additional suture

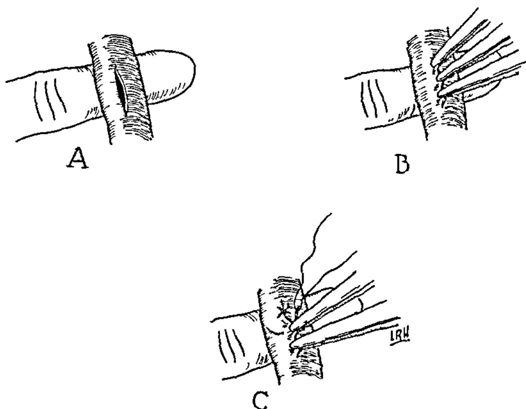


Fig 99 —Illustrating method of repair of large wound in portal or superior mesenteric vein A vessel collapsed by upward pressure from digit beneath B application of hemostats serially close to wound C insertion of interrupted silk sutures beneath each hemostat point as knot is tied hemostat is removed

Schnug reported the successful ligation of the superior mesenteric vein at the lower border of the pancreas necessitated by a bullet wound of this vessel Survival was possible by collateral circulation via the superior and inferior pancreatoduodenal veins as well as by other routes The adjuvant treatment afforded this patient namely heparinization and maintenance of blood volume were also important factors in recovery

The superior mesenteric artery is not so frequently involved by carcinoma in the head of the pancreas as is the superior mesenteric vein The latter is situated to the right of the artery and nearer the head of the pancreas and thus is the first to become involved as a carcinoma of the pancreatic head increases in size Also the pulsations of the superior *mesenteric artery probably result in its walls becoming less intimately* infiltrated by the growth of such carcinomas

As is the case with almost any important vessel gradual occlusion may not result in serious disturbances On *rare* occasions the superior mesenteric artery may become gradually occluded by a thrombus with no clinical evidence of this as in the cases cited by McCollum Trotter and Howse (bibliography by Laufman) In Karcher s case sudden occlusion of the superior mesenteric artery was not fatal and recovery from this accident ensued On the other hand the gradual occlusion may not result in serious anatomic lesions yet normal function is not possible and ileus develops Laufman produced gradual occlusion of the superior mesenteric artery in dogs by wrapping this vessel in Cellophane the latter inducing a constricting fibrosis at the site of its application There was anemia of the intestinal wall and low grade enteritis Gradual occlusion of the superior mesenteric vein resulted in no demonstrable lesions in the intestines This result is expected from the clinical and experimental results of gradual occlusion of the portal vein It would appear that gradual occlusion of the superior mesenteric artery is not feasible in that disturbances usually result from this and that even though such disturbances did not occur the rate of occlusion would of necessity be so slow that it could hardly be a feasible procedure in connection with the surgery of intra abdominal cancer If division of this artery inadvertently occurs at operation every attempt at its reconstitution should be carried out The use of vitallium tubes as recently introduced by Blakemore and Lord may facilitate this

The middle colic artery usually arises from the superior mesenteric a short distance from its origin Variations are not very infrequent how-

ever, and it has been observed to arise from the first mesenteric branch of the superior mesenteric, from the inferior pancreaticoduodenal branch of the latter, from the celiac axis, the common hepatic, etc. (Ziegler). The middle colic artery supplies most of the transverse colon and its occlusion usually leads to gangrene of the central portion of the latter. Neoplasms of the proximal portion of the pancreas, of the lower portion of the stomach, or of the lower portions of the duodenum may include the first portions of the middle colic artery. When such neoplasms are to be resected, the artery may be mobilized by sharp dissection and left behind. On the other hand, if the inclusion of this vessel is extensive and if the central portions of the transverse colon are also involved by the spread of the tumor, resection of the segment of the transverse colon, together with the artery, is carried out. In some instances in which the artery is extensively compromised by tumor growth and the transverse colon not directly involved, the artery is divided near its origin, mobilized en masse with the tumor, and the whole, attached to the transverse colon by its mesentery, is brought out of the abdomen as a "Mikulicz" of the transverse colon.

CHAPTER XVI

OPERATIONS UPON THE SPLEEN INVOLVED IN ADVANCED INTRA-ABDOMINAL CANCER

PRIMARY splenic neoplasms are rare and when encountered are excised by splenectomy. Metastases to the spleen are not infrequently present in advanced carcinomatosis. Ordinarily such extension does not present surgical problems. However, in a few instances the spleen may be spectacularly involved and may be the seat of considerable pain, relief from which, obviating resort to frequent doses of narcotics, might afford effective palliation, especially where the patient's general condition has not yet markedly deteriorated. The usual conservative management, i.e., irradiation therapy to the spleen, is ordinarily recommended and, if it is successful, there is a rather prompt alleviation of pain. However, if this does not obtain and pain persists and if there is no indication that death is imminent, the possibility of splenectomy for palliation may be considered. The author performed a splenectomy in 4 patients because of severe pain due to an enlarged spleen resulting from metastases or direct spread of a malignant tumor arising elsewhere. In each instance the patient's condition did not appear terminal at the time of the operation. In 3 patients the spleen, while markedly enlarged, was not adherent and was removed easily and rapidly by the usual technique, and recovery from the operation itself was prompt and uneventful. In the fourth case there was direct spread of retroperitoneal sarcoma into the hilum and splenectomy had to be carried out by incision through tumor tissue; the latter procedure, as will be related below, was not envisaged as an elective procedure.

Case 73.—O. S. (232140), white male, 57 years old. Reticulum-cell sarcoma excised from the right axilla on December 1, 1939. The patient was ambulatory and able to work. However, during the subsequent weeks there was progressive enlargement of the spleen, which became very painful. At first, the patient walked bent to the left and was unable to stand upright because of rigidity of the left rectus and oblique muscles in the upper left quadrant. He was finally admitted to the hospital and lay constantly in the prone position with thighs flexed and trunk sharply bent to the left. X-ray therapy was ineffectual in relief of pain. On March 23, 1940, a splenectomy was performed, from which convalescence was uneventful, and the severe pain in the region of the spleen was completely relieved. The

spleen showing many large foci of neoplastic tissue weighed 1 308 gm and measured 22 × 14 cm (Fig 100) Death occurred 2 months later the result of rapid progression of *sarcomatosis which did not respond at all to x ray* The terminal clinical picture was exhaustion with practically no pain At the time of splenectomy the patient s nutritive state was good and there was no suggestion that rapid termination would ensue

Case 21 —Jenk (270753) white female 47 years of age The patient had had a simple mastectomy for carcinoma of the right breast in another institution in May 1940 following which x ray therapy was received at intervals In June 1941 *evidence of pulmonary* metastases was present and roentgenograms also showed diffuse osteolytic metastases in various portions of the skeleton In September 1941 *she was admitted to this hospital* and received injections of prolactin and calcium gluconate as an experimental procedure Following this treatment there was spectacular *improvement a return to almost normal* activity resorption of fluid from the chest and gain in weight The improvement was maintained until December 1942 when she was *readmitted complaining of a sense of marked* discomfort because of a large hard mass in the left upper quadrant respirations seemed embarrassed by the mass *Physical examination revealed this to be a markedly enlarged* nodular spleen occupying the entire upper left quadrant Because her general condition in *spite of metastases appeared to be fair and she was still ambulatory splenectomy* was advised to relieve the constant sense of intra abdominal pressure and pain This was per*formed on December 30 1942 without difficulty because the spleen was not adherent* It exhibited many metastatic foci weighed 660 gm and measured 18 × 13 × 10 cm (Fig 101) *Convalescence was at first uneventful and practically afebrile* However at the end of 2 weeks bilateral papilledema and left lateral rectus (eye) palsy suddenly developed *There were short periods of disorientation and amnesia The patient was removed to her* home at the request of her family and died 31 days after operation Necropsy was not per*formed but the clinical picture was that of rapidly developing intracranial metastases* with coma the last few days of life

Case 22 —H H (296440) white female 42 years of age Admitted on January 1 1943 because of skeletal pain of 2 years duration becoming progressively more intense and occasional vomiting 1 year s duration Three years previously a right radical mastectomy had been performed in another institution for carcinoma Physical examination revealed an emaciated white female with a markedly enlarged tender and nodular spleen which filled the upper left quadrant of the abdomen Prior to admission she had been receiving frequent injections of morphine and was an avowed addict Roentgenologic studies revealed multiple skeletal metastases and evidence of pleural thickening with fluid in the right lower chest Her general condition did not appear terminal and by correctly pacing the morphine injections she could be made fairly comfortable The appetite was fair and at times good

After observation for 2 weeks in the hospital it was felt that no small part of the general discomfort in the abdomen which was manifested at irregular intervals *was due to the en*larged and tender spleen Accordingly this was excised on January 18 1943 The patient a nurse realized that this procedure was directed only *toward palliation* The spleen was easily removed because there were no adhesions It weighed 1 474 gm and measured 20 × 16 × 10 cm (Fig 102) Histologic study *showed practically complete replacement of* splenic tissue by metastatic carcinoma

Convalescence was uneventful and afebrile *Considerable relief* was experienced by removal of the large intra abdominal tumor By the middle of February the abdominal com



Fig. 100.—Case 93 (232140). Markedly enlarged spleen (weight 1,308 gm.) with metastatic foci of reticulum-cell sarcoma resected for palliative relief of very severe pain not alleviated by previous x-ray therapy. Relief obtained following resection.

plaints were much less prominent but skeletal pain had increased. On March 13, 1943 she turned in bed and experienced a pathologic fracture in the shaft of the left femur. A cast was applied to the lower body including both inferior extremities. She was discharged to a nursing home on April 5, 1944 and died approximately 6 months after the splenectomy. Considerable relief from abdominal pain was afforded by the operation but the skeletal pain due to metastases had become progressively more pronounced. Necropsy was not performed.

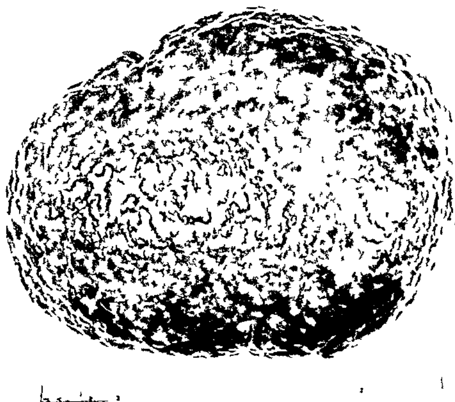


FIG. 101.—Case 91 (270753). Formalin hardened markedly enlarged spleen with its metastases from carcinoma of breast resected for palliation of mechanical symptoms in abdomen. Weight of spleen 660 gm.

Case 67.—Sha (320399), white female, 74 years of age. Admitted to the hospital on March 25, 1944, complaining of increasing weakness for several months, a distressing sense of intra-abdominal pressure constantly present, and a large upper abdominal tumor noted since December 1943. Physical examination revealed an emaciated subject. In the upper left quadrant, extending into the right upper quadrant and upper portion of the lower left quadrant, was a bulging tumor mass visible on inspection. Its surfaces were coarsely nodular. A typical splenic notch was not present. The mass moved with respiration and extended backward into the left flank. Roentgenograms revealed no pulmonary metastases; the stomach was pushed upward and the splenic flexure of the colon pushed toward the mid line and downward. Operation was advised to remove, if possible, the large intra-abdominal tumor which seemed to cause the principal symptoms.

Laparotomy was performed on March 31, 1944, as follows:

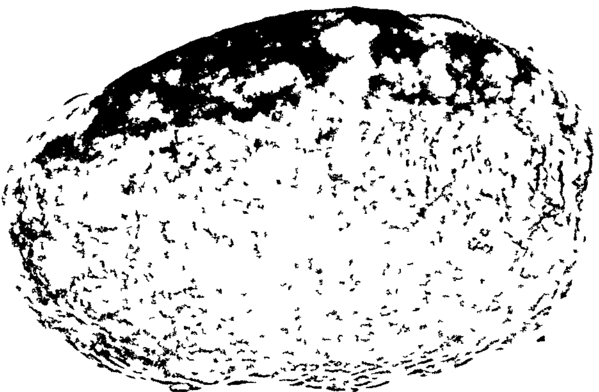


Fig. 102.—Case 29 (296440). Markedly enlarged spleen (weight 1,144 gm.) riddled by metastases from carcinoma of the breast and resected for relief of mechanical symptoms in abdomen. Patient's general condition very good at time of operation (see text).

PARTIAL EXCISION OF LARGE UPPER ABDOMINAL (RETROPERITONEAL) MALIGNANT TUMOR AND SPLENECTOMY

1 The abdomen was entered through an oblique incision parallel to and 6 cm below the left costal arch

2 There was no evidence of diffuse peritoneal metastases or ascites No metastases were noted in the liver The bulging tumor mass consisted of an enlarged spleen, which exhibited *several large metastases visible on the* surface The spleen was intimately adherent to an underlying infiltrating tumor, which displaced other viscera in the left upper quadrant It extended mesially beneath the body of the pancreas elevating and stretching this organ anteriorly, and it infiltrated the retroperitoneal tissues about the upper pole of the left kidney

3 The peritoneal reflections from the spleen onto the diaphragm and the left lateral abdominal wall were incised and an attempt was made to *bring the spleen and the tumor upward into the field by grasping* them on their deep surfaces This was only partially successful, in view of the extensive infiltration of the tumor into the periaortic space Accordingly the tumor mass was incised to the right of the splenic hilum to remove the spleen and the adherent tumor tissue Considerable bleeding occurred from the cut surfaces of the tumor, the splenic artery and vein were divided during this step, as they were imbedded in the tumor, and were secured and ligated

It also became apparent at this time that the neoplasm had infiltrated the posterior gastric wall over a large area During the manipulations a tear 2 cm long into the stomach occurred through the tumor infiltration on the posterior wall of the stomach *This was repaired by two rows of* sutures taking large bites and producing a coarse invagination of tissue

4 Following excision of the spleen and tumor tissue described above the situation remaining was as follows there was a mass of tumor *behind* the pancreas which extended onto the posterior wall of the stomach over the superior margin of the body of the pancreas This mass of neoplasm was continuous with an irregular shaped extension downward into the transverse mesocolon measuring about 8×6 cm To remove all micro*scopic tumor would have required* a total gastrectomy and excision of the body of the pancreas and the transverse colon Because of the patient s condition and age it was decided to proceed no further although her condition at that moment was *satisfactory The principal* accomplishment up

to this point consisted of excision of the gross tumor in the left upper quadrant

5 After hemostasis three large soft rubber drains were inserted into the large space in the left upper quadrant and the abdominal incision was closed

The tumor mass appeared to have originated in the region of the left adrenal gland no evidence of this organ was recognizable at operation or in a study of the excised specimen The latter consisted of the enlarged spleen and an irregular mass of grayish tumor tissue adherent to the posterior aspect and infiltrating the hilum There were several large separate and discrete tumor masses in the spleen itself The whole excised specimen measured 23×16×8 cm and weighed 1 810 gm Separate from the specimen was an irregular mass of grayish tumor tissue weighing *225 gm* (Fig 103)

Histologic sections revealed the growth to consist of *dense masses of* closely applied rounded or polyhedral cells with *central rounded nuclei* and a relatively small amount of cytoplasm *There was little stroma and* in places fine septa seemed to divide the cells into *small solid "acini"* Histologic diagnosis sarcoma *(pleomorphic) or lymphosarcoma*

The postoperative course was satisfactory at first and the *patient ap*peared quite comfortable However on the twelfth day *gastric contents* appeared in the wound at the site of the rubber drain *This did not appear* to be accompanied by unusual *signs or symptoms By the seventeenth* postoperative day however the *patient had become markedly asthenic*, and she expired 2 days later

Necropsy revealed a gastric fistula to have *developed at the site of the* repaired accidental opening made in the *stomach during the operation* There was also a gastric perforation of the wall *infiltrated by tumor tissue* at a point removed from the site of operation *The left adrenal* was present and hence the neoplasm did not arise from this organ as was the impression at one time during the operation *There was extensive* metastasis including metastases in the heart kidneys etc

The first 3 cases discussed in this chapter are instances of marked splenomegaly due to metastases in which the spleen was mobile and easily excised. Resection did afford relief from symptoms referable to the [illegible] At the time of operation these symptoms were the most pronounced and this was the justification for the procedure. [illegible]



Fig. 103.—Case 67 (329309). Resected enlarged spleen weighing 1,810 gm. with adherent mass of *retroperitoneal sarcoma*. S, *MS* metastases in spleen. Operation was begun under impression that most of the tumor could be resected but this did not prove to be feasible. *D* posterior margin of spleen.

ly after operation the benefits of relief from splenic pain seemed to be overshadowed by the general progression of the disease elsewhere. In one patient (Case 21) the rapid development of intra-cranial metastases after splenectomy raises the question of whether the manipulations of the cancerous spleen produced a "shower" of tumor emboli.

It would appear that palliative effects from excision of carcinomatous spleens in the presence of carcinomatosis are brief indeed, and that the operation is indicated only under exceptional circumstances, and especially when irradiation therapy has failed to alleviate symptoms referable to the spleen.

CHAPTER XVII

OPERATIONS UPON THE ADRENAL GLAND

THE surgery of the adrenal glands falls, by custom, within the province of the urologist and the common route of access to these organs is through the conventional lumbar or loin incisions However large neoplasms of these structures may extend forward into the abdomen and afford physical findings which suggest a neoplasm arising from other abdominal viscera or they may involve other abdominal viscera by direct extension The operative approach in these patients therefore is made via abdominal incisions In the case of large adrenal (or renal) neoplasms with extensions to neighboring viscera the principle of wide resection of the tumor and its local extensions is followed as in the case for other intra-abdominal neoplasms discussed in this treatise In some instances the exact site of origin of the neoplasm is not determined until after excision and study of the surgical specimen

The following is an instance of the latter situation

Case 13—L (284407) white male 36 years of age Admitted on April 21 1942 complaining of recurrent attacks of pain in the left upper quadrant for a period of 5 years Two years previously he had been operated upon in another institution where a mass 20 cm in diameter had been observed in the left upper quadrant and biopsied the diagnosis of the latter was not definitely made Subsequently x ray therapy was received at intervals with little relief Physical examination upon this admission revealed a large deeply situated mass of indefinite outlines filling the left hypochondriac region Roentgenograms of the chest were negative Gastric fluoroscopy revealed the stomach to be pushed to the right by an extrinsic mass

Operation was performed on May 7 1942 as follows

NEPHRO ADRENALECTOMY WITH SPLENECTOMY, PARTIAL PANCREATECTOMY AND PARTIAL LEFT DIAPHRAGMECTOMY

1 A left oblique incision was made 8 cm below the left costal arch and parallel to it

2 Inspection and palpation of the abdomen revealed no evidence of hepatic or peritoneal metastases There was a large rounded, tumor mass in the posterior portion of the left upper abdomen bulging forward (Fig 104)

3 The gastrocolic ligament was incised the stomach retracted upward and the transverse colon downward and the body and tail of the pancreas were observed to be stretched rather tightly over the bulging tumor mass posterior to it The upper half of the left kidney was surrounded by the tumor which also extended over the anterior aspects of the upper abdominal aorta and the inferior vena cava Palpation revealed the presence of the right adrenal gland

4 Transection of the lienocolic ligament and the lateral leaf of the mesentery of the descending colon was carried out The left transverse

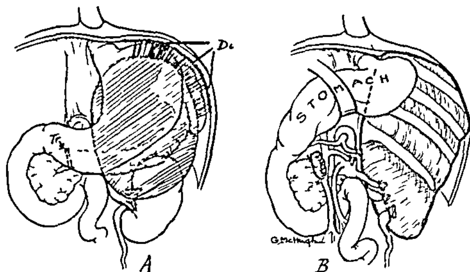


Fig 104—Case 13 (284407) Schematic representation of excision of large carcinoma of left adrenal A showing tumor in situ with body of pancreas stretched over anterior aspect surrounding upper pole of left kidney D region of involvement of left diaphragm Tr transection of neck of pancreas B situation at termination of operation tumor body and tail of pancreas left kidney spleen undersurface of left diaphragm fascia and musculature of posterior abdominal wall resected

colon the splenic flexure and the upper descending colon were retracted well downward and to the right

5 The inferior border of the mass was then identified and freed by sharp dissection The left renal artery and vein were ligated and transected

6 The neck of the pancreas was transected and the proximal stump ligated At this level the splenic vessels were ligated and transected The gastrosplenic vessels were ligated and transected near the stomach The latter was retracted sharply upward and to the right

7 The superior border of the tumor was adherent to the undersurface of the diaphragm In order to free it the peritoneal reflection from the

tumor onto the diaphragm was incised and the dissection was carried backward. Infiltration of the diaphragmatic muscle necessitated splitting the latter *in a horizontal plane* and the dissection was carried backward through the muscle fibers. The diaphragm was perforated on two occasions but was promptly repaired by interrupted sutures.

8. With the spleen as a handle the lateral border of the tumor was then elevated and its deeper attachments divided. The latter step necessitated stripping up the fascia over the psoas and other muscles of the posterior and posterior lateral abdominal wall. *Considerable bleeding from the* lumbar vessels was encountered.

9. Excision of the mass, with the attached spleen, the body and tail of the pancreas, the left kidney and portions of the left diaphragm was then possible. The abdominal wound was closed with two large soft rubber drains to the excision site.

Pathologic study (Fig. 105) provided the following information. The large tumor appeared to replace the left adrenal gland and multiple incisions in it *failed* to reveal a recognizable adrenal gland. *It* surrounded, but did not infiltrate into the upper half of the left kidney. Likewise the pancreas was not actually infiltrated by the growth. The entire resected *mass and appendages weighed 1 360 gm., and the tumor itself weighed* 844 gm. and measured 18 cm. in diameter. Histologic diagnosis: Adenocarcinoma, adrenal gland.

Convalescence was complicated by a subdiaphragmatic abscess which was drained on the fifteenth postoperative day.

The patient was discharged on the forty fifth day. He remains well 4½ years after operation.

The foregoing is an example of an adrenal cortical tumor without endocrinologic activity. On the other hand *adrenal cortical tumors may* be associated with characteristic endocrinopathies depending upon the sex of the patient, the age at development of the tumor and whether excess *androgens or estrogens or* other steroids not yet identified are excreted by the neoplasms. In young males there may be sexual precocity (excess androgens). In female infants there may be a *marked degree of* masculinization including hirsutism and hypertrophy of the clitoris. In adolescent or adult females there may also be masculinization *(excess* androgens). In adult females the typical *Cushing's* syndrome may occur which is characterized by hirsutism, amenorrhea, mild diabetes, osteoporosis, deepening of the voice, coarseness of the skin with *telangiectases*

and characteristic striae on the arms thighs and abdomen hypertension, frigidity and obesity involving the trunk and to a lesser degree the extremities (excess androgens and other steroids) Cushing's syndrome type of adiposity might also be associated with such tumors in the adult male (excess other steroids related to metabolism) In the female Cushing's syndrome without profound sex changes may be the

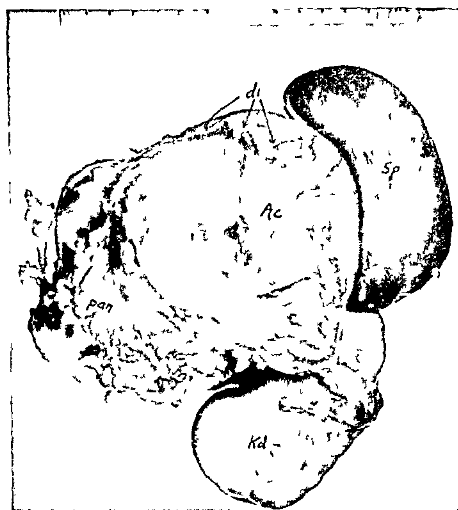


Fig 105 —(Case 13 (281107) Surgical specimen from operation (weight 1 360 gm) described in Figure 104 viewed from anterior aspect of large carcinoma of left adrenal Ac spleen Sp left kidney Kd body and tail of pancreas pan fallen downward The latter was stretched tightly over anterior surface of tumor but not actually invaded by it The undersurface of left diaphragm infiltrated by tumor was resected and only small portion of this di remained on specimen when it was photographed Fascia and muscle from posterior abdominal wall also resected with specimen are not shown Patient is living well and at work 4½ years after operation

result of excess of steroids associated with metabolism and without excess excretions of androgens by the tumor as in the following

Case 54—Star (254514) white female 40 years *of age* The clinical appearance was that of a typical Cushing s *syndrome The changes leading to this appearance* were all of about 4 months duration There was *amenorrhea* hot flashes and dizzy spells hirsutism gain of 25 pounds in weight and *hypertension 220/110 The texture of the skin had become* coarser and purplish striae developed on the abdomen *and breasts* Sexual frigidity was also present and of recent duration *Roentgenographic study may be summarized as follows* normal right kidney left kidney displaced downward and rotated (etiology mass in region of left adrenal?) normal sella turcica *and skull heart 7 per cent undersize lung* fields clear On physical examination *no masses could be palpated in the abdomen* Examination of the retinae showed *hypertensive retinopathy*—early edema of the nerve head fibers Glucose tolerance test yielded a *diabetic curve fasting* blood sugar was 93 mg per cent Blood sodium 147 m E/l Blood potassium 5 5 m E/l

Laparotomy was performed on February 6 1941 *to excise if present* an adrenal neoplasm *Preoperative injections* of desoxycorticosterone and whole adrenal gland extract

EXCISION OF PRIMARY MALIGNANT CORTICAL TUMOR LEFT ADRENAL GLAND IN PRESENCE OF HEPATIC METASTASES

1 *A high mid line incision was made*

2 Inspection and palpation revealed a large irregular tumor mass over 10 cm in greatest diameter in the region of the left adrenal gland, pushing the left kidney downward There were discrete metastatic nodules in the liver not exceeding 0 5 cm in diameter The right adrenal was palpated *and thought* to be normal except *for unusual thinness*

3 The neoplasm was approached by two routes—one over the stomach after division of the gastrohepatic omentum and the second between the stomach and the transverse colon after division of the gastrocolic omentum This complex exposure was necessitated by the size of the tumor and its dense local infiltrative *nature* The *superior* border was freed via the upper route of exposure and the lower portions via the second exposure It was easily separated from the upper pole of the left kidney which it had not infiltrated During resection several large but unidentified blood vessels were divided and ligated

4 After excision *of the primary tumor* there appeared to be none left in the large remaining bed A soft rubber drain was inserted and the abdominal wound was closed in layers

The surgical specimen consisted of an irregular tumor mass with roughened surfaces measuring 15×12×5 cm and weighing 271 5 gm (Figs 106 7) *There were rounded* white haroas separated by wide growth strands of denser tissue Multiple sections of the mass failed to reveal

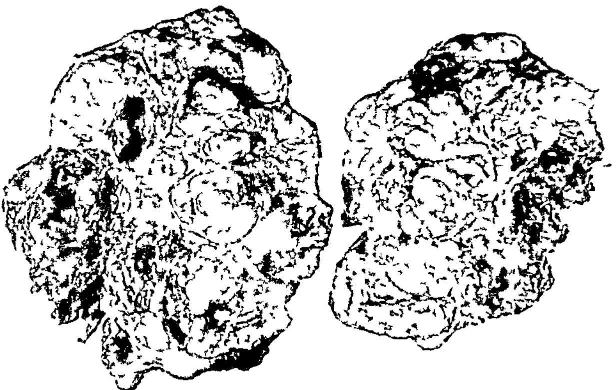


FIG 100—Case 54 (234514) Large infiltrating carcinoma of left suprarenal gland excised en masse with retroperitoneal extensions in presence of hepatic metastases (see text)

gross evidence of the left adrenal gland Histologic study showed a typical adrenal cortical adenocarcinoma

Following the operation the blood pressure fell to 60/40 in spite of relatively little hemorrhage and the injection of 500 cc blood and 1 500 cc saline The patient remained conscious for a few hours and then lapsed into coma A spectacular feature was the gradual development of edema in the extremities especially the legs with large subcutaneous bullae some measuring 15 cm in diameter The blood pressure remained below 70 mg systolic during the next 36 hours in spite of injections totaling 6,800 cc of Ringers saline and dextrose 1 100 cc of blood and 500 cc of plasma The profound shock was interpreted as an acute adrenal insufficiency hence large doses of epinephrine whole adrenal extract desoxycorticosterone calcium gluconate, coramine, and caffeine were given The details need not be cited here inasmuch as the desired effect was not achieved and the patient died the evening of the day following operation

Necropsy revealed the metastases in the liver as noted at operation There was a tumor thrombus in an enlarged suprarenal vein There was a marked atrophy of the right adrenal cortex which resulted from overactivity of the internal secretions from the malignant adrenal cortical tissue of the other side and thus, although the right adrenal was present it was actually nonfunctional Another point of interest in this case was the acute adrenal failure in spite of considerable malignant adrenal cortical tissue metastatic in the liver This would suggest that only the neoplasm at the primary site was endocrinologically active or that the activity of the tumor as a whole was low and that after removal of most of it the remaining portions could not support life Rapid fatal termination in shock has been noted on previous occasions (39 per cent of reported cases [Cahill]) following excision of the above types of adrenal neoplasms and profound shock has been frequently observed when loss of blood was minimal Such phenomena are of course the result of periods of acute adrenal insufficiency resulting from the removal of active adrenal tissue (tumor) in the face of atrophy of the remaining adrenal gland Cahill states Tumors of the Cushing type have been removed and the patient has recovered from the resulting acute adrenal deficiency but often metastases are later recognized and it is thought that their secretion was responsible for the recovery The above experiences would indicate that in some patients at least multiple metastases may not possess sufficient

adrenal-like internal secretions to support life after the primary growth is resected

Large left adrenal neoplasms may on rare occasions simulate neoplasms arising from the descending colon as illustrated by the following patient

Case 4—York ([illegible]) male 55 years old Entered the hospital on October 31 1942 complaining of soreness in abdomen of 6 weeks duration loss of 24 pounds in 4 weeks loss of appetite and enlargement of abdomen during the preceding 3 weeks Prior to this he had been well Examination of the abdomen revealed a moderate amount of ascites A rounded mass was palpable in the left upper quadrant and was considered to be an enlarged spleen possible neoplasm of the tail of the pancreas or neoplasm of the colon Barium enema revealed a constriction in the splenic flexure due it was felt to an extrinsic mass Pyelograms were inconclusive

Laparotomy was performed as follows on November 10 1942

LEFT NEPHRO-ADRENALECTOMY WITH PARTIAL COLECTOMY ENTERECTOMY PARTIAL PANCREATECTOMY AND SPLENECTOMY

1 An L incision was made midline into the left abdominal wall

2 Evacuation of moderate ascites

3 A large tumor mass was found in the left upper quadrant This appeared to surround the upper portion of the left kidney including the left adrenal gland to have infiltrated the wall of the splenic flexure and upper descending colon and onto the tail and distal portion of the body of the pancreas and to have become adherent to a segment of the upper jejunum There were a few metastatic nodules in the greater omentum but none apparent in the liver It thus appeared that there were two points of imminent obstruction in the alimentary canal—one in the splenic flexure of the colon and one high in the jejunum

4 Resection of the mass and its extensions was decided upon The first step was incision of the lateral leaf of the mesentery of the descending colon and gauze dissection of the mass with the spleen from behind the left kidney was brought upward with the mass

5 The gastrosplenic vessels were transected and ligated the left gastrocolic omentum was divided and the stomach was retracted upward to expose the body of the pancreas

6 The body of the pancreas was transected in the mid portion and transection and ligation of the splenic artery and vein were carried out at this level The proximal stump of the pancreas was ligated The distal portion of the body of the pancreas was adherent to the tumor

7 The jejunum was transected on each side of the portion adherent to the tumor thus isolating a segment about 6 cm in length Invagination

of the transected stumps and side to side anastomosis of the jejunum were carried out to re establish continuity

8 The left renal artery and vein were transected and ligated At this point it was *obvious that the periaortic* lymph nodes were invaded by metastatic tumor All these nodes were not resected

9 The mass and adherent structures were now free *except for attachments* of the colon The mass was brought out of the abdomen carrying the transverse colon (freed by division of the hepatocolic ligament at the hepatic flexure) and the upper rectosigmoid colon with it *These loops were brought through the horizontal portion of the L shaped* abdominal incision The mid line portion of this incision was *then closed in layers* with soft-rubber drains to the excision site Clamps were applied to the loops of colon attached to the exteriorized mass and the latter was removed (obstructive "Mikulicz" resection)

Pathologic study of the mass revealed it to consist *of an irregular-shaped neoplasm, 8×8×6 cm*, that arose from the left adrenal gland (Fig 107) and surrounded the upper portion of the left kidney Half of the left adrenal was still recognizable The surgical specimen also included the spleen the distal half of the body and tail of the pancreas the left half of the transverse colon, and the descending colon and a segment of the jejunum 6 cm in length Upon opening the colon in the region of the splenic flexure, it was observed that the tumor had infiltrated the wall, producing constriction and furthermore that there *was a near perforation of the tumor into the lumen* Similar *infiltration* of the segment of the jejunum was also observed

Histologic study of the tumor revealed hypernephroma

Postoperative course The clamps were removed from the colon on the third day and the colostomy functioned satisfactorily thereafter An abscess developed in the left flank and was drained on *the fourteenth day* The patient's general *condition appeared* satisfactory for some time After the thirty sixth day he was afebrile but about this time he became weaker his appetite failed and his condition deteriorated progressively until death occurred 2 months after operation

Necropsy revealed extensive retroperitoneal and peritoneal *metastases* acute fibrinous peritonitis (terminal?) *with ascites and lobar pneumonia*

Another instance of *hypernephroma* simulating an intra abdominal *neoplasm is afforded* by the following patient

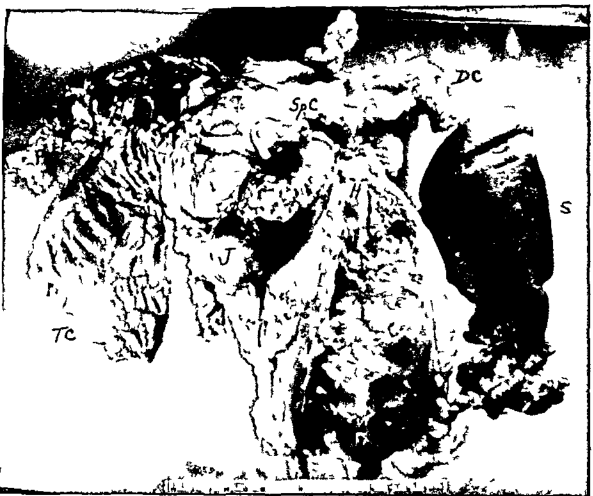


Fig 107 —Case 24 (290221) Surgical specimen consisting of *H* hypernephroma that infiltrated *SpC* splenic flexure of colon and segment of *J* jejunum surrounded upper portion of left kidney *S* spleen *T* tail of pancreas *TC* left transverse colon *DC* mid-descending colon All structures shown were resected en masse Operation terminated by enteroenterostomy and double-barrel colostomy (right portion of transverse colon to lower portion of descending colon)

Case 73.—Mal. (340399), white female, 58 years of age. Admitted on August 9, 1944, complaining of fever every afternoon, weakness, loss of appetite and loss of weight of 5 months' duration. While in the hospital an afternoon rise in temperature to 101–102° F. (oral) was noted. Physical examination revealed a rounded mass in the left side of the abdomen about 10 cm. in diameter that moved with respirations and was slightly ballotable. It did not appear to be the spleen. There was no evidence of ascites. R.B.C. 3,500,000, Hb. 7.5 gm., W.B.C. 14,000. Roentgenograms of the abdomen were interpreted as showing a soft tissue mass anterior to the left kidney. Pyelograms were normal.

Laparotomy was performed on September 9, 1944, as follows:

LEFT NEPHRECTOMY, SPLENECTOMY, AND RESECTION OF PEDUNCULATED HYPERNEPHROMA WITH RETROPERITONEAL INFILTRATIONS

1. The abdomen was entered through a left paramedian incision. There was no excess free fluid and no evidence of peritoneal carcinomatosis. A large, coarsely lobulated, yellowish tumor mass was found present in the left abdomen about 15 cm. in diameter. It was quite mobile but seemed attached on its deeper surfaces. It presented between the leaves of the mid portion of the mesentery of the descending colon. The latter was held rather tightly over its left lateral aspect. There were many large engorged veins over the tumor, some appeared 1–2 cm. in diameter.

2. The mesial leaf of the mesentery was incised over the mass and reflection of the peritoneum from its surfaces was carried out rapidly by gauze dissection. There was considerable bleeding. When the anterior and lateral aspects of the tumor were mobilized it became apparent that it was attached by a rather thin pedicle 3 cm. in width to the inferior pole of the left kidney and that the ureter was intimately attached to the mass.

3. Considerable bleeding continued and it was decided to terminate the operation as rapidly as possible by clamping and dividing the left renal artery and vein and to resect the tumor and the left kidney *en masse*. This was accomplished, and as these structures were elevated, tumor infiltration into the left retroperitoneal spaces was apparent. These extensions were dissected out with the tumor and the kidney. The left ureter was divided and ligated below the pelvic brim. Because there was extension about the hilum of the spleen, the latter was also resected with the other structures mentioned above.

4. Hemostasis was secured by ligating numerous small bleeding vessels in the tumor bed. With the kidney, the tumor and the extensions of the latter removed, the tumor bed shrank rapidly in size. A large soft rubber drain was inserted into it and the abdomen was closed.



Fig 108 —Case 73 (340309) Photograph of *H* hypernephroma that extended forward between leaves of mesentery of descending colon and infiltrated retroperitoneal spaces Portion of tumor *p* extended to hilum of *Sp* spleen, hence latter was also resected A small pedicle of attachment of tumor to lower pole of *K* left kidney The latter was not extensively involved by the tumor The clinical findings suggested intra abdominal neoplasm

The surgical specimen is shown in Figure 108 The total weight was 657 gm The tumor, while actually attached to the kidney, was well demarcated from it in the small area of attachment The main mass measured 12 cm in greatest diameter but this did not include portions that infiltrated the retroperitoneal spaces in all directions

Histologic sections showed typical hypernephroma

Immediate convalescence was satisfactory During the second day the temperature remained normal On the evening of the third day the patient was uncomfortable and had vomited two or three times (300 cc total), but the blood pressure was at preoperative levels—120/82—and there was no fever There was moderate distention of the abdomen At midnight there was a sudden collapse, and the patient expired

Necropsy revealed no evidence of hemorrhage or peritonitis There was, however, marked acute gastric and intestinal dilatation Because the alimentary canal had not been opened and there had been no serious gastrointestinal symptoms, gastric aspiration was not instituted postoperatively Had this been done the fatal outcome as developed might have been obviated

The advantages of the abdominal approach in operations upon the adrenal gland is that both adrenals are readily inspected and extensions of the tumor to adjacent tissues and viscera are more easily dealt with than is possible when the approach is via the loin incision Where a neoplasm of one adrenal is to be excised the opposite one should be inspected and palpated Access to the left adrenal is made by transection of the gastrohepatic omentum after a sharp downward retraction of the stomach and incision of the posterior parietal peritoneum along the upper margin of the body of the pancreas The left adrenal lies immediately behind the mid portion of the body of the pancreas Access to the right adrenal is made by transection of the posterior parietal peritoneum parallel to and a short distance beyond the curvature of the first portion of the duodenum as it joins the second or descending portion

CHAPTER XVIII

OPERATIONS FOR INTRA-ABDOMINAL EXTENSION OF GYNECOLOGIC CANCER—COMPLICATIONS OF IRRADIATION THERAPY

SPREAD of carcinoma of the uterus and adnexae to other abdominal tissues and viscera, especially the pelvic colon and into the omentum, may have occurred while the patient's general condition remains relatively satisfactory. Such extensions often produce obstruction of the bowel. Pain without obstruction may be a prominent symptom. Relief of obstruction by colostomy or by other short circuiting operations above the level of obstruction is indicated although, in the face of intra-abdominal carcinomatosis, some may hesitate to undertake any procedure which might prolong life only for a brief period. Removal of masses of neoplastic tissue, the seat of pain, may afford temporarily appreciable palliation. If laparotomy is performed, with the abdomen open resection of as much neoplasm as is feasible might as well be undertaken in some instances, as there is little to lose and, if relief of pain obtains, some benefit will have been achieved, as is illustrated in the following patient.

Case 31.—Gomel (306531), white female, 52 years of age. Was subjected to laparotomy in the Department of Obstetrics and Gynecology June 28, 1943, at which time peritoneal carcinomatosis was found, secondary to bilateral cystadenocarcinoma of the ovaries. A supra-cervical salpingo-oophorectomy and hysterectomy was performed. Convalescence was uneventful. The patient was discharged on the twelfth day. During the summer of 1943 she was moderately active and there were no serious complaints. During September severe abdominal pain developed, accompanied by attacks of nausea and vomiting. She was readmitted on October 22, 1943, to the surgical service because of failure to obtain appreciable relief from pain and continued nausea and vomiting. Examination revealed a moderately well nourished, middle aged female obviously in severe pain. Palpation revealed a large oval mass, about 15 cm. in diameter, in the mid-abdomen and attached to the abdominal wall beneath the umbilicus. The mass appeared to be quite tender and attempts to "ballote" it aggravated the discomfort. There was no evidence of ascites and the liver was not palpable. There was no cervical or inguinal adenopathy. Pelvic examination revealed considerable induration about the cervical stump, in whose canal was hemorrhagic fungating tissue. X-rays of the chest revealed no evidence of pulmonary metastases. Because of the fair general condition and unsatisfactory attempts to alleviate pain with relatively small doses of narcotics at home, it was decided to resect, if possible, the large mass in the abdomen. This was done as follows:

OMENTECTOMY WITH RESECTION OF UMBILICUS AND SURROUNDING ABDOMINAL WALL FOR METASTATIC TUMOR

1 A low mid line incision was made extending upward about the umbilicus to include this and an elliptical portion of skin about it 8 cm long and 7 cm at greatest width The incisions about the umbilicus were carried through the abdominal wall into the peritoneal cavity These incisions came down upon the tumor mass adherent to the underaspect of the abdominal wall in the periumbilical region

2 The tumor mass about double fist size was essentially in the omentum and was isolated over its inferior and right and left aspects by clamping and transecting adhesions

3 It now became evident that the loops of small and large bowel were studded with numerous small neoplastic metastases Several loops of small bowel were adherent to the omental mass and were freed by sharp dissection sometimes cutting through small metastatic masses

4 One loop of ileum was drawn tightly into the pelvis on the right side and was surrounded by neoplastic tissue This was freed by sharp dissection through tumor tissue and permitted retraction of the bowel upward into the abdomen Adhesions of other loops to the peritoneal metastases were freed in a similar manner

5 The upper aspect of the tumor mass was then freed by transection of the omentum near the stomach and removed Inspection and palpation of the liver revealed a number of metastases in it

6 The abdomen was closed with a soft rubber drain into the pocket in the right pelvis which had previously been occupied by the loop of small bowel described above in step 4

The surgical specimen is shown in Figure 109 Histologic study revealed adenocarcinoma

Convalescence was essentially uneventful The patient however presented severe herpes labialis for several days X ray therapy to the abdomen was given on the 4 final days in the hospital and caused severe nausea There was complete relief from the abdominal pain which had prevailed prior to operation She was discharged on the eighteenth postoperative day and remained in good general condition and fairly active until December 17 1943—55 days after operation—when moderate distention with intermittent abdominal cramps recurred These symptoms were relieved spontaneously at intervals the patient remained ambulatory for 3 more weeks and was admitted to another institution where she died

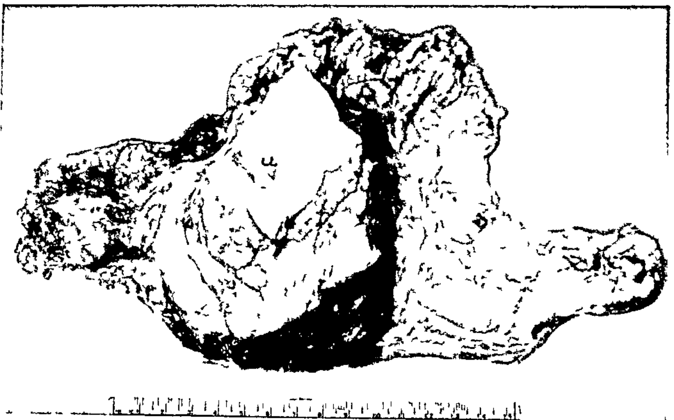


Fig 109 — Case 31 (06534) Resected large metastatic carcinomatous mass (primary in ovary) in greater omentum infiltrating anterior abdominal wall and umbilicus a Practically entire omentum resected with mass The latter was quite painful and relief was obtained following the operation Patient died subsequently of carcinomatosis (see text)

about 3 months after the operation described above Necropsy was not obtained

Another patient with a somewhat similar situation was observed as follows

Case 63—Kap (384560) female 61 years of age Admitted on January 5 1944 because of intermittent severe pains in the right abdomen of 6 months duration These were accompanied by marked abdominal distention but no nausea or vomiting At the time the pains were first experienced she had had a cerebral accident with left hemiplegia there was considerable recovery from the latter at the time of admission Roentgenograms taken in another hospital revealed intestinal obstruction She was also diabetic Physical examination of the abdomen revealed a deep mass in the right upper quadrant Roentgenograms showed no evidence of intestinal obstruction Several paracenteses had been performed elsewhere before admission While in the hospital she had several attacks of very severe abdominal pain and distention These attacks were so severe and her general condition was sufficiently satisfactory that laparotomy for attempted palliation was performed on February 18 1944

PARTIAL COLECTOMY AND ILEOCOLOSTOMY IN THE PRESENCE OF ABDOMINAL CARCINOMATOSIS

The abdomen was entered through a right paramedian incision and this was later extended into the right lower quadrant *Carcinomatosis* was present including hepatic metastases The growth appeared to be primary in the right ovary which however was not more than about 7 cm in diameter In the right portion of the transverse mesocolon there was a carcinomatous mass about 10 cm in transverse diameter and 6 cm in thickness *It appeared to constrict the right portion of the transverse* colon Adherent to its anterior aspect there was a loop of lower ileum also markedly constricted These loci were apparently the sites of obstruction, *and the mass producing them was the only large one* in the abdomen The other metastases did not exceed 2 cm in diameter Accordingly, to obviate *further attacks* a right hemicolectomy with ileotransverse colostomy was performed this procedure also excising the large mass

Histologic study revealed adenocarcinoma *typical of ovarian origin*

The day following operation evidence of pneumonia developed and finally evidence of peritonitis Appropriate chemotherapy (sulphadiazine) for pneumonia was promptly instituted but the patient finally died on the tenth day Necropsy revealed bilateral bronchopneumonia and diffuse peritonitis *There was a minute perforation* of the transverse colon near the ileocolostomy but the abscess thus formed appeared to be well walled off It was the opinion of the *pathologist that the peritonitis* did not arise from this small abscess (2 cm in diameter)

In two other patients with extensive intra abdominal metastases from ovarian carcinoma resections of as many of them as possible were carried out

Case 87 I (348675) presented marked ascites (not pseudo-mucinous) and at laparotomy complete drainage was possible together with excision of the laparotomy scar from a previous operation performed elsewhere at which time a right ovarian carcinoma had been excised The omentum was adherent to the deeper aspects of the scar and contained many metastatic nodules The scar the adjacent portion of the abdominal wall the adherent omentum and several metastases were excised (Fig 110) Convalescence was uneventful but ascites recurred with attendant mechanical disturbances The patient succumbed at home 2 months after operation

Case 95 B (351048) age forty two Admitted as an emergency patient with acute bowel obstruction Several weeks previously exploratory laparotomy had been performed and the presence of carcinomatosis discovered The primary lesion was thought to have been in the right ovary X ray therapy was received with little benefit

At operation performed to relieve the obstruction no actual occlusion of the bowel was found Instead there was a large soft semifluctuant mass of metastatic neoplastic tissue in the retroperitoneal space at the base of the mesentery of the small bowel and separating its two layers Forward compression was exerted against most of the jejunum and the ileum There were also numerous small metastatic masses over the serosal surfaces of the intestines An incision was made through the mesentery of the ileum to permit access to the mass and handfuls of semisolid tumor tissue were literally scooped out of the retroperitoneal space This resulted in a sudden release of compression against much of the small bowel

Convalescence was essentially uneventful The patient following discharge was ambulatory and relieved of symptoms of obstruction Improvement was maintained for about 3 months and then cachexia rapidly developed with return of signs and symptoms of obstruction She died 4 months after operation

In the following patient there were extensive intra abdominal metastases but these did not produce obstruction at the time of laparotomy for resection of them

Case 75 —Jaw (274690) white female 34 years of age First operated upon by the author in December 1941 because of painful lower abdominal mass distention and loss

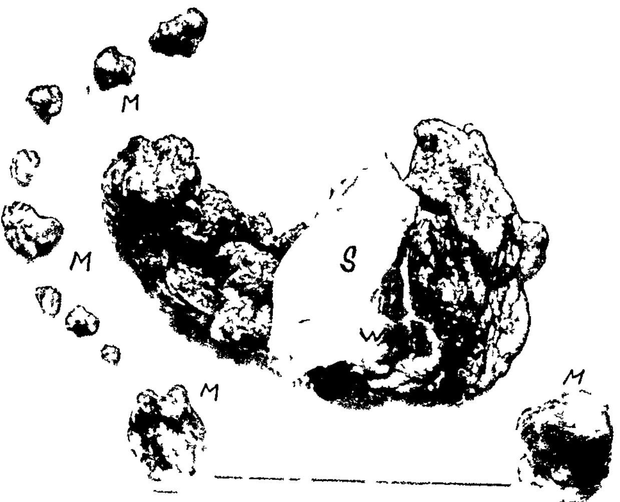


Fig. 110.—Case 87 (318075). Photograph of surgical specimen showing S, scar of previous laparotomy; W, adjacent abdominal wall; M, multiple metastases from serosal surfaces of small intestines.

in weight of 3 months' duration. The abdomen was filled with pseudo-mucinous material; the peritoneal surfaces were covered with minute, firm, whitish nodules. A ruptured cystadenocarcinoma of the right ovary was found, and right ovariectomy was performed. As much of the pseudo-mucinous material as possible was removed, and the abdomen was closed. Following operation, she gained 30 pounds, was very well and normally active. X-ray therapy was administered to the pelvis. On September 10, 1944, she was readmitted not because of specific complaints but because a hard nodular mass could be palpated in the space between vagina and rectum. There was no evidence of ascites. Roentgenograms of the chest were negative. Laparotomy was performed on September 12, 1944, to resect as much neoplastic tissue as possible.

EXCISION OF MULTIPLE PERITONEAL METASTASES FROM CYSTADENOCARCINOMA OF RIGHT OVARY REMOVED 4 YEARS PREVIOUSLY

1. The abdomen was entered through a low midline incision, later extended upward, and thick pseudo-mucinous material was aspirated and wiped away. This material was collected and measured 500 cc. in volume (Fig. 111). The peritoneal surfaces were studded with small firm tumor nodules, measuring 2 mm. to several centimeters in diameter. They seemed to have a predilection for attachment along the free margins of the small and large bowel. The liver did not seem to *contain* metastases, but the anterior surfaces of the right and left lobes presented numerous *nodules upon the capsule. There was dense neoplastic infiltration in the pelvis.* It was decided to resect as much neoplastic tissue as possible.

2. By sharp dissection, nodules were excised individually from along the antimesenteric surfaces of the small bowel and colon.

3. Large masses were resected from the anterior surfaces of the right and left lobes of the liver.

4. *Two large masses were excised from within the mesentery of the* small bowel (upper jejunum).

5. As much neoplastic tissue was removed from the pelvis as possible. The left ovary and tube and the fundus of the uterus were not identifiable. Care was exercised to avoid opening the urinary bladder.

6. An infiltrating mass of tumor tissue was resected from the deeper aspects of the abdominal wall in the right lower quadrant, together with portions of the right rectus muscle.

7. The abdomen was closed without drainage. At the termination of the operation almost all large masses had been removed.

The surgical specimens are shown in Figure 112, and the sites from which they were removed are indicated. Histologic sections showed metastatic pseudo-mucinous adenocarcinoma.

The patient was discharged on the *fifteenth* day. X ray therapy was given to the entire *abdomen*. Two years later she was back at her usual occupation; improvement was maintained, *including* 30 pounds gain in weight.

Sufficient time has not elapsed to permit of the evaluation of the possible benefits from the operation in this *patient*. Pseudo mucinous cyst

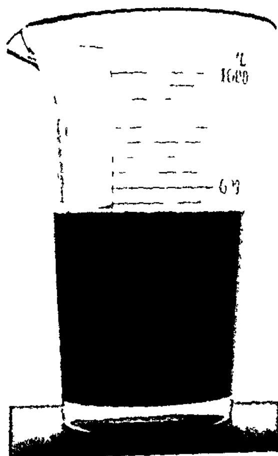


Fig. 111.—Case 75 (2*4090). Showing 500 cc. of hemorrhagic semisolid gelatinous material removed from abdominal cavity prior to excision of multiple metastases.

adenocarcinomas of the ovary are known to pursue a slow course, sometimes several years, especially where irradiation therapy is given. In this patient the latter, while possibly retarding the extension of the growths, certainly did not destroy appreciable quantities of neoplastic tissue. For this reason surgical excision of as much of the tumor as possible was carried out. In general, under such circumstances, when the abdomen is open, the surgeon should not assume that the tumor may be "radiosensitive" and terminate exploration after performing only biopsy, and assign to irradiation the entire burden of treatment. By spending some time in

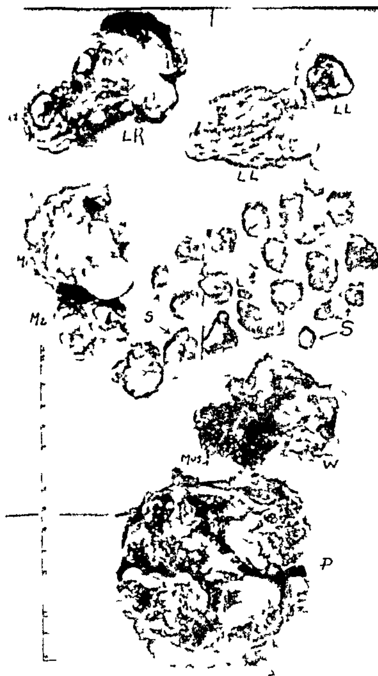


Fig 112 —Case 75 (271090) Photograph of multiple abdominal metastases from pseudomucinous cystadenocarcinoma of right ovary The latter had been resected 2½ years previously and considerable pseudomucinous material taken out of peritoneal cavity *S* nodules resected from free margin of ileum and jejunum *LR* and *LL* metastases from over right and left lobes of liver respectively *M1* and *M2* metastases from within mesentery of jejunum *P* portion of primary tumor over urinary bladder *W* metastasis resected from deeper portions of abdominal wall in right lower quadrant together with *Mus* musculature Patient well and back at work 2 months later

resecting metastases he can accomplish a surer and more extensive reduction in the quantity of neoplastic tissue present than can be accomplished by irradiation These patients should receive the benefits of maximal surgical as well as radiotherapeutic efforts

Where extension or recurrences of ovarian carcinoma are confined to the pelvis the immediate prognosis is of course more favorable Also such local recurrences should not deter the surgeon from excising them although failure to do so is often observed as in the following patient

Case 99, C (354392), sixty-seven years of age Three years previously radium had been inserted into the uterus because of the diagnosis of carcinoma confirmed by biopsy, and later hysterectomy was performed Subsequent examination in another institution revealed a mass in the cul de sac and laparotomy was performed elsewhere A half fist sized mass was found in the position previously occupied by the uterus and was adherent to the anterior aspect of the pelvic colon because of this it was regarded as 'inoperable' and the abdomen was closed Laparotomy was then performed in this institution 6 weeks later and the mass was excised Sharp dissection was necessary to free it from the colon and the peritoneum over the posterior surfaces of the pelvis was also resected There were no liver or peritoneal metastases Histologic study revealed carcinoma probably primary in the uterus (which had previously been resected) A year later the patient is still well and pelvic examination reveals no evidence of recurrences

In the following patient the pelvic colon exhibited marked compression by retroperitoneal extension of ovarian carcinoma

Case 80 H (344973) age sixty nine years *Admitted because of* 'fluid in the abdomen' and a large mass filling the pelvis There had also *been several severe attacks of biliary colic*

Laparotomy was performed through a right para umbilical incision The gall bladder was found to be thickened and distended by numerous stones It was excised in the usual manner The laparotomy incision was then extended downward in the mid line almost to the symphysis pubis and the patient was placed in Trendelenburg position A large fixed nodular mass apparently replacing the left ovary, was found which extended retroperitoneally to the mid line The mass extended between the layers of mesentery of the pelvis and sigmoid colon compressing these segments of bowel into flat ribbon line structures It was difficult to understand why obstructive symptoms had not developed The peritoneum over the

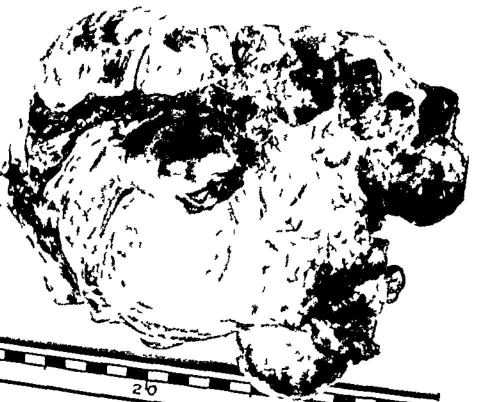
mass was incised and by sharp dissection the mass was finally completely excised without injury to the compressed bowel. The surgical specimens are shown in Figure 113. Histologic study of the mass revealed adenocarcinoma (ovary). One and a half years later the patient remains well and is normally active.

With the extensive use of irradiation in the treatment of gynecologic cancer, complications resulting from the treatment itself may occur. A loop of small bowel situated near the implanted radium in the cervix or corpus may become chronically inflamed, with thickening of the wall, fibrino-purulent exudation over the serosa and ulceration of the mucosa as a result of exposure to irradiation. In time, if the process does not resorb, stenosis of this segment develops and results in varying degrees of intestinal obstruction. Resection of the involved segment is indicated. It is not possible to state how frequently this complication occurs with eventual resorption of the process, since direct visualization of the bowel is obviously not possible in all instances. Possibly the ephemeral attacks of abdominal pain and diarrhea often accompanying or occurring subsequent to irradiation therapy have as their basis such lesions in loops of small or large bowel situated near the uterus. External irradiation with x-rays is also capable of producing inflammatory lesions in the bowel.

In patients who present large carcinomas of the uterus and who receive irradiation which is followed by regression of the tumor and who later develop evidence of bowel obstruction, the conclusion that the latter is due to carcinoma and therefore that the immediate prognosis is very poor *should not be arrived at without careful study for final evidence of such re*currences. It is not extremely unusual to observe spectacular regression of uterine cancer following irradiation. Therefore this possibility should be borne in mind in these patients and the situation should be regarded as a problem of bowel obstruction due to irradiation injury until, as stated, final evidence of recurrent and advanced carcinoma is obtained. Pelvic examination may be misleading, since fibrosis resulting from irradiation may afford physical findings compatible with extensive recurring pelvic carcinoma.

In the three patients described below, pelvic carcinoma treated by irradiation apparently regressed and was followed by irradiation disturbances which at first suggested the diagnosis of recurrent carcinoma because the primary growths were such that control by irradiation alone





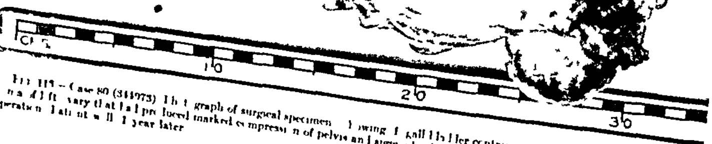


Fig. 119.—Case 80 (344973). Photograph of surgical specimen showing A, gallbladder containing numerous stones; B, large carcinoma of left ovary that had produced marked compression of pelvis and sigmoid colon (see text). Both specimens excised at the same operation. Patient well 1 year later.

was not anticipated and pelvic examination revealed findings consistent with recurrent carcinoma.

Case II.—G. H. (201832), female, [illegible] years of age. Admitted to the Gynecologic Clinic on June 21, 1941, because of profuse vaginal discharge. Examination revealed a large carcinoma, stage 3–4, of the cervix, biopsy of which showed it to be of the squamous-cell type. X-ray therapy (6,000 r calculated tumor dose) was given to the pelvis, which brought about marked regression of the tumor. Because of this, in September, 1941, radium ([illegible]400 mg. hr.) was inserted into the cervix. In December, 1941, direct examination of the cervix revealed apparent complete regression of the lesion, but manual pelvic examination gave the impression to the gynecologist that extension into the adnexae had developed. The patient lived in another city and was not seen again until January 14, 1943. A right-sided colostomy (double barrel) had been performed in another institution in January, 1942, because of acute bowel obstruction. Pelvic examination by the gynecologist revealed masses completely filling entire pelvis. It was the impression that a carcinoma had spread extensively in the pelvis.

The patient was again admitted on February 22, 1943. The "upper barrel" (distal loop) of the double-barrel colostomy in the mid portion of the right abdomen had become prolapsed and was gangrenous. The "lower barrel" (proximal) was markedly stenotic. Pelvic examination revealed induration in both adnexal regions; the vault of the vagina and the cervix were markedly contracted. Roentgenograms of the chest were negative.

Operation was performed as follows (Fig. 114):

A low midline incision was made, and the stenotic afferent loop of the colostomy (the ascending colon) was brought through a new opening in the right lower quadrant. The prolapsed gangrenous upper loop (which was formed by the right transverse colon) was resected, and the freshened distal loop brought out in the upper angle of the midline incision. During this operation no gross evidence of carcinomatosis was found in the upper abdomen. Convalescence was complicated by an abscess in the right abdominal wall. The patient was discharged on the fortieth day postoperative. She was again admitted in May, 1943. The colostomy was functioning well. Barium enema revealed complete occlusion of the upper rectal colon. On rectal examination, induration and constriction of the colon were felt, but the finger did not attain a completely obstructed point.

Pelvic examination revealed no change in the induration within the pelvis. The vagina seemed almost completely obliterated, but there was no gross evidence of neoplasm in the cervix. The patient was extremely insistent upon closure of the colostomy. Apart from the pelvic induration

there was no frank evidence of metastatic cancer. There had been no loss in weight; the appetite was good.

On May 29, 1943, laparotomy was again performed as follows:

1. A low midline incision was made.

2. Extensive adhesions were present in the pelvis and about the rectal colon, which was constricted in its upper portion to form a solid rounded cord. The sigmoid and rectal colon were mobilized by division of all adhesions; the left lateral leaf of the peritoneum along the sigmoid colon was

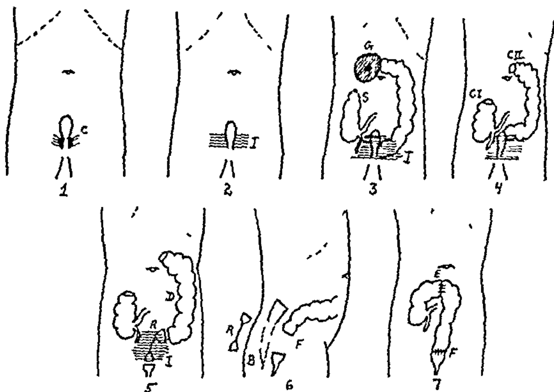


FIG. 114.—Case 11 (264932). Diagrams showing: 1, condition on admission to gynecologic clinic June 1941 (advanced squamous-cell carcinoma of cervix (biopsy) with ulceration and parametrial induration, clinical Type 3–4). Irradiation therapy summer of 1941, after which lesion sclerosed but parametrial induration increased. 2, condition December 1941.—I, pelvis frozen, owing, it was thought, to carcinomatous invasion. 3, condition on readmission February 1943. One year previously a colostomy had been performed in another city because of obstruction in lower colon due to recurrent carcinoma. I, pelvic infiltration had increased. S, stenosed ascending colostomy; G, prolapsed and gangrenous loop of distal segment of colostomy. 4, after operation: CI, freshened colostomy; CII, gangrenous and prolapsed portion of distal loop excised and colon transplanted in midline incision. At this time no carcinomatous metastases were found. 5, laparotomy again performed May 1943: R, stenosed segment of rectal colon; I, and D, descending colon and sigmoid mobilized. Patient turned on abdomen. 6, B, lower sacrum and coccyx removed to permit of just[?] exposure and excision of stenosed colon (R), end-to-end anastomosis of colon. F. Biopsies of pelvic tissues and of uterus failed to reveal carcinoma. 7, final operation August 1943: E, end-to-end anastomosis of ascending colon to left transverse colon. Patient well, no evidence of carcinoma 5 years 7 months after initial operation; normal function of colon (see text).

also incised and the latter was then pushed into the pelvis as far as possible

3 The patient was then turned into the prone position with hips flexed A T shaped incision was made over the sacrum and the coccyx The coccyx and lower third of the sacrum were resected and the upper pelvic and lower sigmoid colons were brought out into the field A segment of colon 10 cm in length including the completely constricted portion was excised The remaining segment of the anal and lower rectal colon measured about 8 cm in length

4 A large hard rubber tube was inserted into the anus and guided upward through the open end of the lower segment of colon Anastomosis of the lower sigmoid to the upper end of the anal colon was then carried out with two rows of interrupted catgut sutures The end of the tube was pushed upward about 5 cm above the line of anastomosis The tube was sutured to the skin adjacent to the anus

5 Muscles fascia skin and subcutaneous tissue were closed over the anastomosis and a soft rubber drain was inserted

During the above operation fragments of dense sclerotic tissue were removed from about the atrophic uterus and from within the thickened and shrunken broad ligaments from the hollow of the sacrum and about the anal colon for microscopic study in view of the previous history of large carcinoma of the cervix treated by irradiation Microscopic study of sections of these tissues failed to reveal evidence of carcinoma The complete stricture was obviously an inflammatory one and sections of the colon revealed no evidence of infiltrating neoplasm

Convalescence was complicated by infection of the posterior wound but this eventually healed The large tube in the anal colon was discharged spontaneously on the tenth day The patient was discharged on the forty second day

She was again admitted on August 23 1943 for closure of the abdominal colostomy This necessitated a mid line incision since the distal loop was in the mid line above the umbilicus and the proximal loop was in the right lower quadrant The latter was freed brought toward the mid line and the distal loop freed and united to the former by end to end anastomosis The wound healed almost per primum The patient was discharged on the twenty first day postoperative

Prior to this closure a barium enema revealed a constriction at the site of anastomosis but an adequate lumen was present in the pelvic colon

Following discharge the patient became *normally active, there was* control of the two to three small *stools* that were passed each day. Rectal examination revealed moderate constriction at the anastomosis site but there was no clinical evidence of bowel obstruction. Three years and 7 months after the initial operation in this institution the *patient is still* normally active without clinical evidence of *carcinoma*.

Case 12—Bl (264391), 55 years of age. *There was more or less constant vaginal bleeding* for several weeks prior to admission to the Gynecologic Clinic on July 22, 1941, at which time curettage of the uterus revealed an "undifferentiated adenoma—*malignant*." Radium was inserted into the uterus (5,400 mg hr) and x ray therapy to the pelvis was administered during September 1941 to a depth dose of 3,900 r in the uterus and 2,100 r to each of the adnexal regions. Her condition remained satisfactory until March 1942 when she was readmitted with distended abdomen, cramping pains, alternating diarrhea and constipation, gross blood in the stool, and recent loss of 15 pounds in weight. Pelvic *examination revealed an immobile uterus, the outlines of which could not be made out because* of the abdominal distention, and a questionable mass in the right adnexa. Palpation of the abdomen revealed an "indefinite mass" in the lower portions thought to be recurrent and metastatic carcinoma. Temperature 101° F, blood pressure 110/68, pulse 80. The results of barium enema fluoroscopy were reported as follows: "Marked wide spread obstruction of the lower sigmoid, probably not intrinsic, suspect metastatic involvement encroaching on the lumen."

Because of the obvious intestinal obstruction laparotomy was performed (Fig. 115) on March 31, 1942. There was no evidence of carcinomatosis. *The lower sigmoid* was bound down firmly behind the corpus and there were many adhesions in the pelvis. In separating the rectal colon from its adhesion to the posterior aspect of the uterus by sharp dissection, a circular patch of dark necrotic colon was encountered, in the center of which was a small perforation. The latter was closed by a purse string suture. The uterus appeared atrophic. A supravaginal panhysterectomy was done. The omentum was sewed over the darkened patch in the rectal colon wall, and a loop colostomy, using the upper sigmoid, was performed through a stab wound in the left lower quadrant. The abdomen was closed with a soft rubber drain to the cul de sac of *Douglas*.

Examination of the surgical specimen revealed no evidence of carcinoma in the uterus and adnexae. Tissue about the cervix and uterus was examined for neoplastic cells but none were found.

Convalescence was *complicated* by relatively mild cystitis and infection in the mid line incision. The patient was discharged on the fifty fifth *day after operation*. During the following week a rectovaginal fistula developed but eventually closed spontaneously.

Four months later, the patient's condition being satisfactory, she was readmitted to the hospital for barium enema fluoroscopy; the latter showed relatively less stenosis over a more limited segment than previously.

Laparotomy was again performed on September 28, 1942. The abdomen was entered through a low midline incision. The sigmoid and rectal colon were mobilized by division of numerous adhesions. The stenosed firm

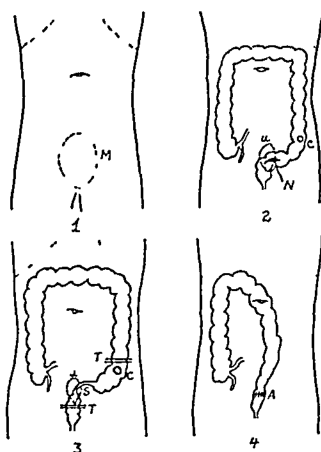


Fig 115.—Case 12 (261391). *1*, condition on admission March 1942, previous irradiation therapy for carcinoma of corpus uteri (biopsy). *M*, large palpable mass in lower abdomen thought to be recurrent and metastatic carcinoma; clinical evidence of obstruction in lower colon. *2*, laparotomy performed: mass found to be distended colon above *N*, stenosed segment of colon with perforation to posterior aspect of *u*, previously irradiated uterus. *C*, loop colostomy; no gross evidence of recurrent or metastatic carcinoma. *3*, Laparotomy again performed September 1942. The repaired site of perforation in the colon was now in the center of a firmly stenosed segment of colon, *S*; the descending colon and sigmoid were mobilized and a segment 18 cm long including stenosed site and colostomy site *T–T'* excised with panhysterectomy. *4*, termination of operation by end-to-end anastomosis *A* of lower descending colon to upper rectal colon. Histologic study of uterus, excised colon and pelvic areolar tissues failed to reveal carcinoma. Patient well 2 years and 3 months later with normal colon function.

segment of rectal colon measured about 5 cm in length The colon was transected several centimeters distal to this segment The colostomy was detached from the abdominal wall and the colon immediately above this was transected A large hard-rubber tube was passed into the rectal colon and out the anus The upper segment of the colon was then brought down into the pelvis and anastomosed end to end by two rows of interrupted sutures over the tube, the upper end of the latter having been pulled upward for several centimeters above the level of the anastomosis The midline abdominal wound was closed with drainage and the site of the colostomy was also closed in layers The rubber tube was cut off a short distance beyond the anus and sutured to the skin on each side of the latter

The surgical specimen consisted of 18 cm of colon, in the lower portion of which was a stenosed segment 5 cm in length In this region the colon wall was composed principally of dense fibrous tissue and there was a small shallow, mucosal ulcer Histologic study revealed no evidence of carcinoma

Convalescence was complicated by infection in both the midline and the closed colostomy wound These infections were not serious, however, and the patient was discharged on the twenty ninth day after operation

She was seen at intervals in the outpatient department Her condition improved rapidly and there was gain in weight and return to normal physical activity Bowel movements were normal

Four years and 6 months after operation the patient continues to be well

In both the above patients the skin and subcutaneous tissues in the portals of irradiation in both lower quadrants and on the buttocks was rigid—exhibited atrophic changes and telangiectases In the first patient an incision into the abdomen was of necessity made in the right lower abdominal port of irradiation It was the distinct impression that the relatively poor state of the tissues contributed to the development of infections in this region and with slow recovery from it In the following patient irradiation injury to the abdominal wall was very extensive and included injury to the underlying bowel

Case 70 —Zich (30 372) white female 41 years of age Admitted on February 10 1943 Eight years previously the patient had been seen in medical consultation in another city and the diagnosis based on biopsy of a uterine carcinoma invading the rectum and pelvis had been made There had been increasing constipation Radium was inserted and then x ray treatments were given One and a half years later eight more treatments had been re

ceived. Two years previous to this admission a recurrent pelvic tumor developed associated with vomiting and considerable pain. Nine x-ray treatments were given and 6 months later a similar course was repeated. About 14 months previously redness developed in the lower mid abdomen which progressed to ulceration and the latter in the previous few months had slowly increased in size.

Examination revealed a large, painful, rounded and indurated area in the lower mid abdomen beneath the umbilicus, in the center of which was an ulceration 6×4 cm. in size (Fig. 116). The skin in the lower right and left quadrants was telangiectatic and the abdominal walls were rigid. Pelvic examination revealed no definite masses although the examination was not satisfactory because of an inflammatory rigidity in the lower abdominal walls. Barium enema fluoroscopy revealed a stricture in the lower sigmoid colon. Operation to remove the ulcer, reconstitute the abdominal wall and resect the injured bowel and possible recurrent intra-abdominal neoplasm was undertaken as follows (Fig. 117).

RESECTION OF LOWER ABDOMINAL WALL, HYSTERECTOMY, PARTIAL COLECTOMY

1. A large vertical elliptical incision to include erythematous and ulcerated regions of the lower abdominal wall was made to the umbilicus. *When it was carried through into the peritoneal cavity, no gross evidence* of carcinomatosis was found. There were no hepatic metastases.

2. The uterus was small and atrophic. A supra-cervical panhysterectomy was performed. There was no gross evidence of carcinoma.

3. A segment of lower sigmoid colon was found constricted because of chronic inflammation. The serosa was opaque and roughened. The bowel wall was thickened and indurated. This lesion was excised by removal of a segment of colon 11 cm. in length, and an end to end anastomosis was performed with two rows of interrupted sutures.

4. Owing to the extent of resection of the lower abdominal wall and the induration in the right and left lower quadrants, the edges of the large defect could not be approximated. Accordingly, deep fascial strips were raised on each side and brought together in the mid line, and two skin flaps down to and including the muscle layers of the abdomen were mobilized from each lower quadrant and brought together in the mid line. These sutured into place permitted reconstitution of the abdominal wall. The flaps, however, fashioned from tissue that had been damaged by irradiation, were stiff and the wound closures were made under considerable tension.



Fig 116 — Case 76 (902372) Large ulceration in lower abdomen due to previous x-radiation of carcinoma of uterus (diagnosis confirmed by biopsy) Pelvic examination revealed diffuse induration suggestive of recurrence There was severe pain due to ulceration Operations performed are depicted in Figure 110

Study of the excised portion of abdominal wall revealed a typical radiation ulceration. The uterus, tubes and atrophic ovaries revealed no evidence of carcinoma. The segment of constricted sigmoid colon revealed an oval chronic ulceration 5 cm. in length in the mucosa at the site of the constriction. At the limits of resection the bowel appeared normal.

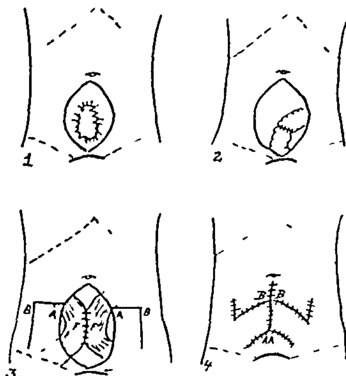


Fig. 117.—Case 76 (302372). Clinical diagnosis—irradiation ulcer of abdominal wall and recurrent carcinoma of uterus and pelvis. Illustrating several steps in operation. *1*, elliptical incisions about irradiation ulcer in abdominal wall. *2*, attenuated segment of sigmoid colon excised; no gross evidence of carcinoma found and supra-cervical panhysterectomy also performed. *3*, abdominal wall rigid because of previous irradiation to both lower quadrants and wound edges could not be approximated. *F-F*, fascial flaps raised from lower quadrants and approximated in midline. Skin and subcutaneous flaps raised *B-A* and *A-B* and approximated. *4*, closure of skin under tension (see text).

The patient remained in the hospital 55 days following operation. The repairs in the abdominal wall, although remaining intact at first, finally broke down and the incisions had separated by the end of a month. By the twenty-fourth day a fistula from the urinary bladder had developed necessitating the insertion of a retention catheter via the urethra in an attempt to reduce the escape of urine from the fistula. Following discharge from the hospital the patient remained confined to bed at home in another city and died 4 months after the operation. Sloughing of the

tissues in the lower abdomen was progressive, and a small bowel fistula developed before death. It was the impression that, whereas the operation was not successful in respect to repair, some benefit resulted in that the severe pain associated with the large irradiation ulcer was alleviated and the patient was more comfortable than prior to operation. Possibly life was shortened by the operation.

In the last three patients cited the operations were undertaken to resect, if possible, recurrent carcinoma. For this reason they are included in the discussions of this essay. The successful results in the first two instances serve again to emphasize the fact that intensive irradiation therapy is capable of inducing complications which might be interpreted on the basis of clinical findings as recurrent carcinoma, especially when the latter was originally of large size, and that, since control of such lesions may nevertheless result from irradiation, these patients should not be regarded as presenting recurrent carcinoma until final conclusive evidence is obtained but should be managed as patients with irradiation injury until final proof (biopsy) of the recurrences. Errors in treatment and in prognostication will thus be avoided.

CHAPTER XIX

RESULTS OF RADICAL SURGICAL EXCISION IN 100 CASES OF ADVANCED ABDOMINAL CANCER

WHILE successful massive resections of advanced intra-abdominal cancer may be carried out with immediate survival of the patient, this alone does not justify general advocacy of a more radical attitude in regard to the surgery of such growths unless there is evidence to demonstrate the achievement of appreciable palliative results in a significant number of patients. If the latter cannot be achieved, massive resections must be regarded merely as surgical "tours de force" and cannot be accorded recognition as procedures to be envisaged in sound surgical practice.

In the type of patient considered in this essay, 5-year survivals cannot frequently be anticipated, although there is 1 patient who has survived over 9 years and 1 over 10; there are 2 surviving over 5 years. The surgery of advanced intra-abdominal cancer is essentially a surgery of palliation. The purpose of this study is to examine the possibilities afforded by radical procedures in achieving palliation as contrasted with the conservative practices of noninterference or of performing the limited procedures that characterize "short circuiting" operations.

To take the position that attempts at extending operative treatment in advanced cancer in the face of certain criteria of "inoperability" are not justified is to imply that operative surgery has reached its fullest development in the treatment of abdominal cancer and is not capable of further exploitation. Such assumptions would be unwarranted without actual trial. It might be stated that simple short circuiting operations are not infrequently followed by prolonged palliative response and that such operations would continue to be indicated rather than subjecting some of the patients to a more extensive procedure. There is no question but that short circuiting operations (including colostomy above the growth) are sometimes followed by spectacular palliative responses; on the other hand the frequency of this is much less than is generally believed to be the case since numbers of such patients are classified as having had advanced

cancer on the basis of clinical findings and gross observations at laparotomy, without *biopsy confirmation* of the diagnosis. The numbers of patients who presented remarkable survivals following simple short circuiting operations are greatly reduced when only those cases are considered that had histologic confirmation of the diagnosis. Many grossly "inoperable tumors" were, in reality, inflammatory masses.

The criteria for estimation of results in this treatise is the degree of palliation afforded. This is not easy to evaluate since for each patient there is no "control" and no two patients are comparable. Also there is no "base line" for longevity estimations in patients with advanced intra-abdominal cancer. Suffice it to state that when symptoms are such as to lead to laparotomy and advanced carcinoma is found, the life expectancy is usually brief. However, nothing more than an encouraging attitude on the part of the attending physician, which affords, among other things, improved nutrition, will not very infrequently result in remarkable palliative responses. The writer has observed patients who had advanced cancer gain 10–37 pounds before this was suspected, as a result of improved nutrition and relief of pain by the judicious use of sedatives.

IMMEDIATE OPERATIVE MORTALITY

In none of the patients cited in this treatise was there fatality during the operation itself. Various definitions of immediate surgical mortality may be formulated, ranging from death within a few days of the operation to whether the patient leaves the hospital alive, regardless of the length of postoperative hospitalization or of what manner of complications may have developed. In this study an operative mortality is defined empirically as death within 30 days of the operation, regardless of cause. The patients presented advanced cancer and by usual criteria this was in the "inoperable" stage. When multiple operations were performed and death occurred following the last operation, this was not regarded as a fatality of the initial operation, where this was performed for palliation in the presence of already advanced cancer.

The all inclusive mortality statistics according to this definition are as follows:

Number of patients operated upon	100
Number of postoperative deaths	14
Immediate surgical mortality as defined above	14 per cent

The initial endeavors in extending operative surgery have always been accompanied by an appreciable mortality. The mortality of partial

gastrectomy at the beginning of this century was such as to raise the question of its ever becoming a widely utilized procedure. The mortality of the combined abdominoperineal resection was approximately 50 per cent two decades ago. The initial mortality of total pneumonectomy challenged the courage of pioneers in this field. The high mortality in the early days of intracranial surgery was proverbial. The operative mortality in the series of patients presented in this essay, namely 34 per cent, is therefore not in itself a discouragement in view of the nature of the conditions for which these operations were performed. In many instances metastases were present that were not excised. In some cases death was a foregone conclusion because the hepatic artery, the portal vein, or the superior mesenteric vein of necessity had been ligated. With increased experience in this type of surgery, greater technical facility is developed, better supportive treatment is devised, and there is better selection of cases—hence all these factors will contribute to lowering the operative mortality in future endeavors along these lines.

For further analyses of the results achieved the patients have been divided into four groups as follows:

Group I.—Prolonged survival with appreciable palliation. Survival for at least 1½ years without evidence of recurrences and return to usual occupation.

Group II.—Appreciable palliative response with survival to 1½ years or a little longer. Palliative results appeared to have justified the operation.

Group III.—Survival of more than 1 month with no appreciable palliative response or with palliative response too brief to ascribe much benefit to the operation.

Group IV.—Postoperative fatalities.

The patients in these groups are summarized in Tables 12–16, with discussions of each series.

In the group of 19 patients given in Table 12, considerable benefit resulted from the operations. At this writing 14 are alive, over 2 years to over 10 years after operation. Two of the patients (Cases 11 and 12) proved not to have carcinoma after the operations were completed. These patients are included in the series because, when their operations were undertaken, it was the impression from clinical study that carcinoma which had previously existed as shown by biopsy had produced extensive pelvic invasion. It was in an attempt to ameliorate symptoms that the

TABLE 12

Group I Prolonged Survival with Marked Palliation and Return to Usual Activities

(As of October 1 1946)

Case and Treatise Serial No	Operation	Survival
1 F C	Resection of carcinoma first loop of jejunum extending into its mesentery and distal half of body *of pancreas and adjacent retroperitoneal tissues*	10 years, 1 month
78 Helf	Transduodenal resection of large carcinoma and second portion of duodenum together with posterior duodenal wall invaded by *tumor resection of margin of head* of pancreas beneath tumor reimplantation of common bile and pancreatic ducts	9 years, 1 month
2 J I	Resection of massive carcinoma (islet-cell) in body of pancreas with its extensions into stomach and jejunum	8 years, 11 months (died)
3 N A	Resection of *three-fifths of stomach and left lobe of liver for carcinoma* of stomach adherent to left lobe one deep metastasis found in left lobe	5 years 5 months
7 Zar	Hemicolectomy partial ileectomy partial hepatectomy for carcinoma *of hepatic flexure invading liver and loop of ileum*	5 years, *2 months*
4 H S	Total gastrectomy splenectomy and omentectomy for carcinoma of fundus with *extensive* regional lymph node and omental metastases esophagogastric transection very close to gross margins of tumor	4 years 9 months
77 Web	One stage *pancreatoduodenectomy for infiltrating carcinoma* of ampulla extending 3 cm up common duct	2½ years (died)
14 J	Partial pancreatoduodenectomy resection of massive fibrosarcoma of duodenum and upper retroperitoneal spaces and regional *lymph node metastases including tho e in porta hepatis*	3 years, 6 months (died)
15 C B	Hemicolectomy and resection of abdominal wall for carcin ma primary in cecum but involving abdominal wall and small bowel	2½ years (died)
5 J C	Hemicolectomy partial gastrectomy and resection of mi l portion of abdominal wall for massive carcinoma of transverse colon	4 years, 3 months
13 I	Resection of massive carcinoma of left adrenal left nephrectomy excision of body and tail of pancreas, portions of left diaphragm and fascia and muscles of left posterior abdominal wall	4 year 4 months
8 An	Subtotal gastrectomy resection of regional lymph node metastases and entire omentum for carcinoma of stomach previously perforated and repaired elsewhere	2 years, 1 month (died)
6 Cot	Hemicolectomy partial jejunectomy partial ileectomy for metastatic carcinoma of stomach (resected 1½ years previously)	2 years, 2 months (died)
10 N C	One-stage pancreatoduodenectomy for large carcinoma of ampulla *and regional lymph node* metastases, including node in porta hepatis	3 years, 4 months

TABLE 12—*Continued*

Case and Treatise Serial No	Operation	Survival
11 C H	Carcinoma of cervix of clinical type 3 b previously treated by irradiation multiple operations to re-establish continuity of colon in the presence of clinical evidence of advanced recurrent and inoperable carcinoma of cervix closure of colostomy	3 years 4 months (after final operation)
12, BI	Carcinoma of corpus previously treated by irradiation multiple operations to re-establish continuity of colon in presence of clinical evidence of advanced recurrent and inoperable carcinoma of fundus closure of colostomy	4 years, 6 months (after final operation)
38 L. R	Massive carcinoma of splenic flexure and left portion of transverse colon with extension onto distal portion of body of pancreas, mid portion of posterior gastric wall and metastases in greater omentum no hepatic metastases resection en masse of left portion of transverse colon upper descending colon spleen body of pancreas, lower half of stomach all of omentum colostomy (right transverse colon and lower descending colon) latter subsequently closed	2 years 4 months
41 Jar	Carcinoma of mid sigmoid, infiltrating parietal peritoneum in left lower quadrant and invading loop of lower ileum to production of ileocolic fistula resection en masse of sigmoid loop of ileum, and deeper portion of abdominal wall in left lower quadrant colostomy latter subsequently closed	2 years 6 months
42 Kil	Large liposarcoma in right retroperitoneal space with extension to near main branches of superior mesenteric vessel also had severe nephritis, in itself considered contraindication to operation resection of large sarcoma convalescence uneventful, living and well and normally active nephritis improved	2 years 5 months

operations were performed A conservative management based upon a false assumption that recurrent carcinoma was present would have resulted in erroneous prognosis and the prolonged persistence of colostomies to say nothing of the psychologic and social aspects of the situations Furthermore these patients serve as examples of fortunate outcome that may obtain in some instances when operations are not refused simply because of suggestive clinical evidence of recurrent and advanced cancer

Excluding the latter two patients there are 17 cases in whom prolonged palliation was afforded These individuals all resumed their normal activities They represent 17 per cent of the entire series of 100 patients considered in this treatise Of the 6 who died 1 lived 3 years and 11 months and died as a result of a complication of the third laparotomy 1 lived 2 years and 6 months and died of coronary occlusion 3 weeks after the third operation 1 lived 2 years and 6 months dying of metastases

1 lived 2 years and 1 month and died of carcinomatosis 1 died of carcinomatosis, 2 years and 3 months after resection of multiple metastases from previously resected carcinoma of the stomach, and 1 died after 3 years and 6 months of metastases The average survival of the 6 patients who died was 33 months They had all resumed their normal occupations for a time The average survival to date of the 11 living patients who had advanced visceral carcinoma at the time of operation is 40 months and they exhibit no evidence of *recurring neoplasm*

In the group of 24 patients with satisfactory palliative results that justified operation (Table 13) the average survival was 6 months Four patients survived for 14 14, 12, and 11 months respectively In 3 instances—Cases 22 23 and 40—surviving 6 months 2 months and 6 weeks respectively the patients did remain in bed after operation In the first case there were extensive skeletal metastases from carcinoma of the breast and in the latter 2 there was lymphosarcomatosis—they received palliation All the other patients *became ambulatory and left the hospital following operation* They remained ambulatory for varying periods The average survival for 17 patients in whom hepatic metastases were not appreciable at *operation* was 7 *months In 7 patients* who had such metastases or retroperitoneal spread not excised at operation the average survival was 4 months

In the group shown in Table 14 the average survival as of December 1 1945 was 10 5 months All have returned to their usual occupations One patient (Case 75) has evidence of recurrence in the pelvis but a 30 pound gain in weight is maintained and she continues to work in her usual occupation (NOTE November 1 1946, living and well)

The average survival of the 17 patients of the group shown in Table 15 was 3 months This compares with the average survival of 6 0 months for 24 patients in Group II*a* who received sufficient palliation to have justified the operations performed upon them and who have since died

In the group in Table 15, 4 patients presented obvious hepatic or retroperitoneal metastases *which remained* after excision The average survival of these was 1 3 months as compared to an average survival of 4 months for 7 patients in Group II*a* who had obvious remaining hepatic metastases at the time of operation but who exhibited palliative response following operation

Group III comprises 17 per cent of the entire series considered in this essay (Table 15)

TABLE 18

Group IIa: Patients Who Have Died—Appreciable Palliative Results in Patients Surviving up to 1 Year or a Little Longer—Operation Justified in View of Palliative Response—Death from Carcinomatosis

Case and Tr[illegible] Serial No.	Operation	Result
27 C C	Resection of left half of transverse colon with carcinoma, splenic flexure, ascending colon, portion of body of pancreas, spleen and upper retroperitoneal tissues; no hepatic metastases noted	Lived 1 year 2 months; satisfactory palliation for 12 months
18 S I	Resection of gallbladder, right and left hepatic ducts, common hepatic ducts, and upper common bile duct, and portion of head of pancreas for carcinoma of extrahepatic bile duct; no hepatic metastases noted	Lived 1 year; complete relief from jaundice for 10 months; regained lost weight; returned to full normal activity for several months
19 H	Resection of lower stomach, first portion of duodenum and portion of head of pancreas for carcinoma of first segment of duodenum; no hepatic metastases noted; periaortic metastases present	Lived 11 months; died of carcinomatosis
57 M Fent	Carcinoma of upper rectal colon adherent to and infiltrating loop of lower sigmoid; multiple hepatic metastases but no peritoneal carcinomatosis; carcinoma produced severe rectal tenesmus (as many as 20 small bloody stools a day); combined abdominoperineal resection in spite of metastases to remove lesion causing symptoms	Lived 8 months; gained weight; was ambulatory and free from rectal symptoms; appetite good for several months; died of carcinomatosis
34 F R	Resection of portion of left abdominal wall and segment of colon for recurrent carcinoma of colon; no hepatic metastases noted	Lived 10 months; obstruction of colon obviated; satisfactory palliation for 6 months
26 Hor	Partial resection of massive leiomyosarcoma of lower ileum and drainage of intratumoral abscess; no hepatic metastases noted	Lived 7½ months; satisfactory palliation for 5 months
16 Whit	Resection en masse of entire stomach, spleen, body and tail of pancreas and transverse colon for carcinoma primary in stomach; no hepatic metastases noted	Lived 6 months; satisfactory palliation for 4½ months; gained 10 pounds in weight
22 H H	Splenectomy for extensive splenomegaly due to metastases (primary in breast); hepatic metastases present	Lived 6 months; relieved of severe pain referred to spleen
43 Flad	Pancreatoduodenectomy for large carcinoma of head of pancreas; no hepatic metastases	Lived 5½ months; gained weight and icterus cleared completely
17 Fri	Total gastrectomy with splenectomy and resection of body and tail of pancreas, for carcinoma primary in stomach; no hepatic metastases noted	Lived 5 months; satisfactory palliation and gain in weight for 3½ months
44 Her	Pancreatoduodenectomy for large carcinoma of head of pancreas; retroperitoneal lymph node metastases; no hepatic metastases	Lived 5 months; gained weight; icterus completely relieved

TABLF 13—*Continued*

Case and Treatise Serial No	Operation	Result
25 Coh	Resection *of right and left hepatic ducts* common hepatic duct common bile ducts and gall bladder for carcinoma of extrahepatic bile ducts	Lived 5 months relieved of icterus and attendant symptoms
31 Gomel	Resection of large metastatic intra abdominal tumor mass and its invasion into periumbilical portion of abdominal wall resection of entire omentum hepatic metastases present primary carcinoma of right ovary	Lived 4 *months relieved of* severe pain for 2 months
45 Webst	Total pancreatectomy subtotal gastrectomy splenectomy and *resection of entire omentum for carcinoma* of mid portion of body of pancreas with extension to above structures	Lived 3 months after operation *relief* from severe abdominal pain
82 B	Resection of gall bladder right and left hepatic ducts, common hepatic and common bile ducts for carcinoma of extrahepatic biliary ducts T tube to right *hepatic duct* sinus and *stump* of common duct no hepatic metastases seen	Lived 4 months relieved of pain and jaundice
88 K	Transthoracic resection of lower esophagus upper half of stomach spleen body *and tail of pancreas* and retroperitoneal tissues for carcinoma primary in upper stomach no hepatic metastases seen	Lived 9 months returned to work *for brief period* enjoyed eating
89 Se	Excision of multiple large hepatic metastases from liver primary source not determined relieved of acute upper abdominal pain	Lived 3 months
9? I	Pancreatoduodenectomy for large carcinoma of body *of pancreas no hepatic metastases*	Lived 2 months relieved of pain and icterus
95 B	Resection of multiple intra abdominal and retroperitoneal metastases from ovarian carcinoma liver not examined	Lived 4 months
9 I H	Massive carcinoma of sigmoid direct extension into dome of urinary *bladder left spermatic cord (intra* abdominal portion) anterior parietal peritoneum in *left lower quadrant* infiltration into loop of ileum with production of ileocolic fistula and metastases in mesenteric nodes of ileum extending upward to include a node near the main trunk of the superior mesenteric artery Resection en masse of involved sigmoid dome *of urinary* bladder terminal portion of left spermatic cord *parietal peritoneum and deep fascia* of left lower quadrant involved segment of ileum and corresponding mesentery to near main trunk of superior mesenteric artery with metastatic nodes colostomy closure of colostomy at later date	Patient well and worked as *truck driver* for 9 months with no clinical evidence of carcinoma gained 25 pounds after operation in tenth month after operation had thrombosis *of left femoral* vein with swelling of left *leg this* subsided with no frank clinical evidence of recurrent carcinoma appetite gain in weight and activities maintained a year after operation developed abdominal pain evidence *of recurrences*, and died 14 months after operation

TABLE 13—*Continued*

Case and Tre t se Ser. 1 No	Operation	Result
36 L h	Resection of distal portion of body of pancreas spleen lower two-thirds of stomach periumbilical region of abdominal wall and falciform ligament for carcinoma primary in body of pancreas with metastases to other structures that were removed no hepatic metastases noted	Lived 4 months relieved of pain
20 W J	Resection of massive carcinoma of transverse colon lower half of stomach spleen body and tail of pancreas hepatic metastases present colostomy	Lived 3 months no pain
40 Bek	Resection of entire stomach body and tail of pancreas left lobe of liver transverse colon omentum spleen fascia and musculature of anterior abdominal wall and upper retroperitoneal tissues for massive lymphosarcoma of stomach extending into adjacent structures	Lived 2 months enjoyed excellent palliation
23 O S	Splenectomy for massive splenomegaly due to metastatic reticulum-cell sarcoma extensive abdominal lymph node metastases present pain in spleen very severe not previously relieved by x ray	Lived 6 weeks relieved of abdominal pain

TABLE 14

GROUP IIb PATIENTS LIVING AND WELL LESS THAN 18 MONTHS AFTER RADICAL RESECTION

Case and Tre t se Ser. 1 N	Operation	Result
Jaw	Excision of multiple intra-abdominal metastases from carcinoma of right ovary excised almost 4 years previously	Living 14 months after operation back at work
80 H	Resection of large ovarian carcinoma (left) infiltrating retroperitoneal tissues of pelvis and markedly compressing pelvic and lower descending colon also cholecystitis and cholelithiasis cholecystectomy	Living 12 months no evidence of recurrences
93 Let	Pancreatoduodenectomy with excision of lower portion of stomach and regional lymph node metastases for carcinoma of pylorus invading head of pancreas	Living 10 months no evidence of recurrences
94 Zi	Radical gastrectomy with excision of transverse mesocolon and regional lymph node metastases about superior mesenteric vessels stomach was found to contain three neoplasms viz., one scirrhous carcinoma near pylorus one benign papilloma and one ulcerating carcinoma	Living and well 10 months after operation no evidence of recurrences
98 D	Radical gastrectomy splenectomy and resection of body and tail of pancreas because of extension of gastric carcinoma into the latter	Living and well 9 months after operation back at work
99 C	Resection of recurrent carcinoma of uterus in pelvis adherent to pelvic colon had had previous hysterectomy and irradiation therapy	Living and well, 8 months after operation no evidence of recurrences

TABLE 15

GROUP III PATIENTS SURVIVING MORE THAN 1 MONTH WITH NO APPRECIABLE PALLIATIVE RESPONSE OR WITH PALLIATIVE RESPONSE TOO BRIEF TO HAVE JUSTIFIED RADICAL OPERATION ALL DIED OF CARCINOMATOSIS (EXCEPT CASE 76)

Case and Treatise Serial No	Operation	Results
33 N	Pancreatoduodenectomy for secondary invasion of carcinoma into head of pancreas primary in stomach no hepatic metastases noted	Lived 4 months
76 Zich	Resection of lower abdominal wall and segment of colon and panhysterectomy for large irradiation ulcer in abdominal wall due to therapy of previously diagnosed carcinoma of the uterus (biopsy) no remnants of carcinoma found	Lived 4 months
96 Bec	Resection of a large segment of left abdominal wall to include scar of previous operation and cutaneous metastases resection of segment of colon (previous site of Mikulicz resection) for recurrences and excision of multiple intra abdominal metastases	Lived 5 month slight palliation
81 M	Right hemicolectomy omentectomy and partial duodenectomy for carcinoma of cecum infiltrating mesentery and retroperitoneal tissues, with extension onto second portion of duodenum no hepatic metastases postoperative wound disruption and duodenal fistula	Survived 1½ months died of "exhaustion
83 S	Partial pancreatectomy splenectomy for carcinoma of body of pancreas also excision of large solitary metastasis in right lobe of liver	Survived 5 months brief palliation
87 F	Resection of multiple upper abdominal metastases from previously excised ovarian carcinoma no hepatic metastases	Survived 2 month no palliation
90 M Coh	Right hemicolectomy excision of multiple intra abdominal metastases and portion of anterior abdominal wall for spread of previously excised carcinoma of ovary	Survived 3 months little palliation
91 Loeb	Resection of multiple intra abdominal metastases including segment of abdominal wall primary growth in descending colon (previously resected)	Survived 4 months little palliation
97 T	Radical one-stage pancreatoduodenectomy for carcinoma of third portion of duodenum invading head of pancreas and producing regional lymph node metastases no hepatic metastases	Survived 3 months little palliation
35 F S	Total gastrectomy splenectomy and resection of body and tail of pancreas for invasive carcinoma of stomach no hepatic metastases noted	Lived 3 months
32 M Wal	Resection of gall bladder right and left hepatic ducts and common hepatic and upper common bile ducts for carcinoma of extrahepatic bile duct no hepatic metastases were noted had little pain before operation icterus reduced but not completely relieved	Lived 4½ months
24 Nork	Resection of left half of transverse colon spleen tail of pancreas segment of jejunum left kidney and large invasive hypernephroma no hepatic metastases noted	Lived 2 months

TABLE 15—*Continued*

Case and Treatise Serial No	Operation	Results
27 Basl	Resection of lower three-fifths of stomach, all of omentum and gallbladder for metastatic carcinoma primary (?) no hepatic metastases	Lived 2 months
28 Len	Resection of massive lymphosarcoma of lower abdomen with 78 cm of ileum and jejunum, dome of urinary bladder, retroperitoneal tissue, and gallbladder (with metastases) retroperitoneal metastases remained, but none noted in liver	Lived 1½ months
29 Mag	Resection of body and tail of pancreas, spleen and retroperitoneal tissues for carcinoma of body of pancreas, no hepatic metastases noted at operation, necropsy revealed large intrahepatic metastasis	Lived 1½ months
30 M K	Resection of body and tail of pancreas and spleen for carcinoma of pancreas producing severe pain, hepatic metastases present	Lived 1½ months, relieved of pain
31 Jenk	Splenectomy for painful splenomegaly due to metastases from carcinoma of breast, hepatic metastases present	Lived 1 month

The causes of death in the group of 34 patients shown in Table 16 are summarized as follows

Peritonitis—no gross evidence of perforations	6
Peritonitis—ischemic perforations or leakage of anastomosis	6
Pulmonary complications (pneumonia, atelectasis)	6
Accidental resection of segment of hepatic artery (and portal vein in one case)	3
Accidental ligation of superior mesenteric vein	1
Thromboses, intrahepatic radicles of portal vein	2
Uremia	1
Exhaustion—patients markedly debilitated by carcinomatosis, no specific cause of death revealed at necropsy	1
Acute gastric dilatation	1
Acute adrenal insufficiency	1
Multiple thrombi in splanchnic vessels and ischemic necrosis of gastric stump	1
Necropsy not obtained	5
Total	34

Peritonitis was the principal cause of death having been verified in 12 instances. In all these patients chemotherapy with the sulpha drugs was instituted but did not afford evidence of favorable action. However, in view of demonstrable perforations in 5 instances it could not have been

TABLE 15

GROUP III PATIENTS SURVIVING MORE THAN 1 MONTH WITH NO APPRECIABLE PALLIATIVE RESPONSE OR WITH PALLIATIVE RESPONSE TOO BRIEF TO HAVE JUSTIFIED RADICAL OPERATION ALL DIED OF CARCINOMATOSIS (EXCEPT CASE 76)

Case and Treatise Serial No	Operation	Results
33 N	Pancreatoduodenectomy for secondary invasion of carcinoma into head of pancreas primary in stomach no hepatic metastases noted	Lived 4 months
76 Zich	Resection of lower abdominal wall and segment of colon and panhysterectomy for large irradiation ulcer in abdominal wall due to therapy of previously diagnosed carcinoma of *the uterus (biopsy) no remnants of carcinoma found*	Lived 4 *months*
96 Bec	Resection of a large segment of left abdominal wall to include scar of previous *operation and cutaneous metastases* resection of segment of colon (previous site of Mikulicz resection) for *recurrences and excision of multiple intra abdominal metastases*	Lived 5 months slight *palliation*
81 M	Right hemicolectomy omentectomy and partial duodenectomy for carcinoma of cecum infiltrating mesentery and retroperitoneal tissues with extension onto second portion of duodenum no hepatic metastases postoperative wound disruption and duodenal fistula	Survived 1½ months died of exhaustion
83 S	Partial pancreatectomy splenectomy for carcinoma of body of pancreas also excision of large solitary metastasis in right lobe of liver	Survived 5 months brief palliation
87 I	Resection of multiple upper abdominal metastases from previously excised ovarian carcinoma no hepatic metastases	Survived 2 month no palliation
90 M Coh	*Right hemicolectomy excision of multiple intra abdominal* metastases and portion of anterior abdominal wall for spread of previously excised carcinoma of ovary	Survived 3 months little palliation
91 Loeb	Resection of multiple intra abdominal metastases including segment of abdominal wall primary growth in descending colon (previously resected)	Survived 4 months little palliation
97 T	*Radical one-stage pancreatoduodenectomy for carcinoma* of third portion of duodenum invading head of pancreas and producing regional lymph node metastases no hepatic metastases	Survived 3 months little palliation
35 I S	Total gastrectomy splenectomy and resection of body and tail of pancreas for invasive carcinoma of stomach no hepatic metastases noted	Lived 3 months
32 M Wal	Resection of gall bladder right and left hepatic ducts and common hepatic and upper common bile ducts for carcinoma of extrahepatic bile ducts *no hepatic metastases* were noted had little pain before operation icterus reduced but not completely relieved	Lived 4½ months
24 York	Resection of left half of transverse colon spleen tail of pancreas *segment of jejunum* left kidney and large invasive hypernephroma no hepatic metastases noted	Lived 2 months

TABLE 15—*Continued*

Case of Treatise Serial No.	Operation	Result
27 Basl	Resection of lower three-fifths of stomach, all of omentum and gallbladder for metastatic carcinoma; primary (?); no hepatic metastases	Lived 2 months
28 Lew	Resection of massive lymphosarcoma of lower abdomen with 78 cm. of ileum and jejunum, dome of urinary bladder, retroperitoneal tissues and gallbladder (with metastases); retroperitoneal metastases remained but none noted in liver	Lived 1½ months
29 Mag	Resection of body and tail of pancreas, spleen and retroperitoneal tissues for carcinoma of body of pancreas; no hepatic metastases noted at operation; necropsy revealed large intrahepatic metastasis	Lived 1½ months
30 McK	Resection of body and tail of pancreas and spleen for carcinoma of pancreas producing severe pain; hepatic metastases present	Lived 1½ months; relieved of pain
31 Jenk	Splenectomy for painful splenomegaly due to metastases from carcinoma of breast; hepatic metastases present	Lived 1 month

The causes of death in the group of 34 patients shown in Table 16 are summarized as follows:

Peritonitis—no gross evidence of perforations	6
Peritonitis—ischemic perforations or leakage of anastomosis	6
Pulmonary complications (pneumonia, atelectasis)	6
Accidental resection of segment of hepatic artery (and portal vein in one case)	3
Accidental ligation of superior mesenteric vein	1
Thromboses, intrahepatic radicles of portal vein	2
Uremia	1
"Exhaustion"—patients markedly debilitated by carcinomatosis; no specific cause of death revealed at necropsy	1
Acute gastric dilatation	1
Acute adrenal insufficiency	1
Multiple thrombi in splanchnic vessels and ischemic necrosis of gastric stump	1
Necropsy not obtained	5
Total	34

Peritonitis was the principal cause of death, having been verified in 12 instances. In all these patients chemotherapy with the sulpha drugs was instituted but did not afford evidence of favorable action. However, in view of demonstrable perforations in 5 instances, it could not have been

TABLE 16

Group IV Patients Who Died within 30 Days of Operation and Considered Immediate Operative Mortality

Case and Treatise Serial No	Operation	Results
60 Forb	Resection of part of right lobe of liver gall bladder duodenal stump transverse colon and large carcinomatous mass in transverse colon Recurrence of carcinoma 6 years after subtotal gastrectomy for carcinoma	Survived operation for 30 days died of peritonitis and wound disruption
46 Razg	Total gastrectomy resection of body of pancreas spleen and transverse colon for massive carcinoma of stomach	Survived 12 days died of peritonitis—microscopic (?) leakage at esophagojejunal anastomosis
47 Benz	Resection of left half of transverse colon upper portion of descending colon spleen and distal portion of body of pancreas for carcinoma of splenic flexure also cholecystectomy for metastases in gall bladder wall patient also had hyperthyroidism and received subtotal thyroidectomy 10 days prior to above operation	Died fifth day necropsy revealed peritonitis
48 Hmt	Total pancreatectomy with resection en masse of lower end of pylorus entire duodenum first few centimeters of jejunum and spleen	Died second day massive bilateral lobar pneumonia
53 Rich	Total pancreatectomy with resection en masse of lower end of pylorus entire duodenum first few centimeters of jejunum and spleen	Died ninth day—exhaustion (?)
49 Far	Resection of body and tail of pancreas and spleen	Died third day necropsy revealed intrahepatic thrombosis in large radicles of portal veins with infarction of liver
50 Hil	Resection of left half of transverse colon and upper descending colon distal portion of body of pancreas spleen and segment of jejunum	Died third day necropsy revealed peritonitis
51 Prol	Resection of gall bladder lower common hepatic and upper common bile ducts for carcinoma segment of hepatic artery resected with tumor	Died 17 hours later massive infarction of liver
52 Smol	Resection of gall bladder lower common hepatic and upper common bile ducts for carcinoma segment of hepatic artery resected in tumor	Died twenty second [illegible] necropsy revealed infarctions in liver
54 Star	Resection of large carcinoma (endocrinologically active) of cortex of left adrenal en masse with its extensive spread in retroperitoneal tissues of left side of abdomen and periaortic nodes liver metastases were present	Died second day of acute adrenal insufficiency although other adrenal was present it was atrophic and hepatic metastases [illegible] not afford adequate internal secretion to substitute for resected primary growth

TABLE 10—*Continued*

Case and Treatise Serial No.	Operation	Results
53 Lasw	One-stage pancreatoduodenectomy with resection of extensive spread from about superior mesenteric and middle colic arteries	Died fifth day—exhaustion (?) necropsy not obtained patient was elderly female and had marked hypoproteinemia (4 6 gm per cent) postoperatively which was not benefited by repeated blood and plasma transfusions
57 Cant	Total gastrectomy splenectomy and resection of body and tail of pancreas for carcinoma of stomach that had perforated some time previously with chronic abscess formation beneath left lobe of liver abscess resected with stomach possible because of thick wall about it	Died eighth day peritonitis
59 Wiat	Total gastrectomy resection of body and tail of pancreas and spleen for carcinoma primary in stomach	Died fourth day peritonitis
58 Dar	Pancreatoduodenectomy for carcinoma of neck of pancreas adherent to termination of superior mesenteric vein accidental opening of latter led to ligation of portal and superior mesenteric veins	Patient survived to tenth day and died of bile peritonitis—leakage from transected common duct
61 Bl	One-stage pancreatoduodenectomy and resection of lymph node metastases in porta hepatis	Died tenth day of uremia necropsy revealed no hemorrhage or peritonitis cause of uremia not determined
62 Jard	Total gastrectomy splenectomy and resection of posterior parietal peritoneum over body of pancreas for carcinoma of stomach which spread to latter	Died second day peritonitis (?) necropsy not obtained
70 F	Resection of descending colon and large portion of left abdominal wall including extension of carcinoma and abscess in abdominal wall	Died sixth day uremia (?) necropsy not obtained
84 C	Subtotal gastrectomy total pancreatectomy splenectomy and transverse colectomy for round cell sarcoma involving the above structures	Survived 19 days died of separation of gastrojejunal anastomosis peritonitis etc
85 N	Resection of extrahepatic bile duct and gall bladder—cholangiocholecystocholedochectomy for carcinoma of bile ducts	Survived 16 days died of cholemia and uremia icterus not relieved
86 D	Subtotal gastrectomy splenectomy subtotal pancreatectomy resection of major portion of transverse mesocolon for carcinoma of stomach extending into above structures	Survived 22 days died of peritonitis
100 D	Resection of pylorus for carcinoma and excision of multiple large hepatic metastases	Survived 1 day (30 hours) died of shock (?)

Case and Treatise Serial No	Operation	Results
63 Kap	Right colectomy and excision of extensive metastases in *mesentery from carcinoma primary in* right ovary	Died tenth day of peritonitis secondary to perforation of colon near ileocolostomy
64 Kueh	Resection of upper half of stomach and lower half of esophagus for massive carcinoma invading upper third of stomach and lower third of esophagus	Died third day of massive right atelectasis and pleural effusion necropsy revealed no evidence of hemorrhage peritonitis, or mediastinitis
65 Kris	Resection of massive *carcinoma of body of pan*creas and its retroperitoneal extensions and splenectomy	*Died of accidental ligation of* superior mesenteric vein 2 hours after operation
68 Mart	One-stage pancreatoduodenectomy for lymphosarcoma involving entire duodenum	Died sixth day of pneumonia
66 Rh	*Resection of entire transverse colon spleen and* entire omentum for carcinoma of mid portion of transverse colon	*Died ninth day—peritonitis (?)* necropsy not obtained
71 Ash	Transthoracic total gastrectomy with resection of lower fourth of esophagus splenectomy and resection of body and tail of pancreas and upper *retroperitoneal lymph node metastases for car*cinoma involving upper two-thirds of stomach *and lower 4 cm of esophagus*	Died tenth day of peritonitis due to perforation of duodenum near site of invagina*tion of duodenal stump*
67 Sha	Partial resection of massive retroperitoneal sarcoma and spleen	Died eighth day of exhaustion
56 Tolf	Total gastrectomy splenectomy and resection of body and tail of pancreas and spleen for carci*noma of stomach with spread to pancreas*	*Died third day peritonitis*
70 Ky	Cardioesophagectomy and splenectomy resection of portion of diaphragm infiltrated by tumor and of metastatic nodes along lesser curvature of the stomach and from upper retroperitoneal spaces	Survived 3 days necropsy revealed numerous thrombi in small veins at attachment of *large and small bowel* to mesentery and vascular impairment of upper portion of stomach with minute perforation above level of diaphragm
69 Wil	Carcinoma of upper end of stomach with invasion of body of pancreas, large segment of mid por*tion of left leaf of diaphragm infiltration* of upper retroperitoneal tissues and metastases to periaortic nodes there was a high degree of obstruction of lower esophagus Transthoracic resection of lower end of esophagus spleen upper *two-fifths of stomach body of pan*creas retroperitoneal extension mid portion of *left diaphragm* accidental opening of abdominal aorta during attempt to dissect off neoplastic tissue from anterior aspect repair after considerable hemorrhage	*Died short time after return to* his room necropsy not performed

TABLE 16—*Continued*

Case and Treatise Serial No	Operation	Result
72 Cl	Resection of right and left hepatic, common hepatic, common bile duct and gallbladder for carcinoma of extrahepatic bile ducts no hepatic metastases noted accidental opening of right branch of portal vein portal vein and hepatic arteries both accidentally clamped clamps removed fourth day	Died eighth day necropsy revealed septic infarction of liver
73 Mal	Resection of large hypernephroma and left kidney —abdominal incision neoplasm attached to inferior pole of left kidney by small pedicle but extended forward infiltrating between layers of mesentery and descending colon and in retroperitoneal tissue	Died third day acute dilatation of stomach and small bowel
74 Th	Pancreatoduodenectomy one stage for large carcinoma of head of pancreas	Died third day necropsy revealed bilateral aspiration pneumonia carcinoma had infiltrated into body of pancreas beyond level of resection

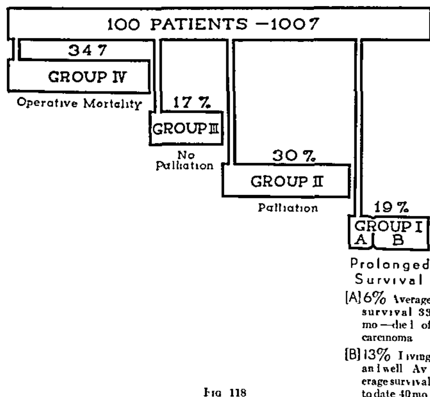


Fig 118

expected to limit the process in these cases The development of peritonitis without gross evidence of leakage or perforation was undoubtedly due to the fact that massive partially necrotic carcinomas already infected from the stomach or bowel were subjected to extensive manipulation and then widespread divisions of mesentery with opening of lymphatic channels from the above sites were carried out resulting in contamination of the field by infected lymph Many of these minute lymphatic channels were left patent Furthermore extensive resection of the omentum and stripping of the parietal peritoneum left large spaces in which infected lymph and exudate accumulated in the face of reduced omentum and peritoneal defenses'

Group IV—the immediate mortality—comprises 34 per cent of the entire series considered in this essay The average survival was 9 days

The results are summarized in Figure 118 A third of the patients succumbed as a result of operation added to this a sixth of the series survived but received little benefit from massive resection Together these groups represent half of the series—failure cases A third received appreciable but relatively temporary benefits and almost a fifth of the series received marked and prolonged benefits Together, the latter groups represent the other half of the series—the successful cases Thus in 100 patients subjected to massive resections for advanced inoperable' abdominal cancer beneficial and sometimes unusually favorable results were achieved *in half of the patients*

CHAPTER XX

CONCLUSIONS

IN THIS treatise considerable discussion has been devoted to the procedures from which the patients did not recover or from which little benefits were derived. The purpose of this was to afford some impression as to what might be regarded as the limits of operative surgery per se irrespective of what manner of complications might have ensued to result in fatal termination. A review of the various procedures carried out, among those who survived and those who did not, fails to afford a definite impression as to a limit of operative attack in so far as resection of viscera and tissues is concerned. It would appear that, as a result of the actual experiences herein recorded, the only limits to operative resection of intra-abdominal structures are the limitations afforded by the minimal requirements of certain structures for normal physiologic activity, viz., a portion of one adrenal, possibly 30 per cent of the small bowel, sufficient renal tissue for adequate urine secretion, etc. The feasibility of radical surgical excisions are specially emphasized by such examples as Case 45, in whom practically all the stomach, the omentum, all the pancreas, and the spleen was resected with no greater postoperative disturbances than are observed after the ordinary radical gastrectomy, and by the more radical procedure carried out in Case 40, in which the entire stomach, half of the left lobe of the liver, the body and tail of the pancreas, the spleen, the transverse colon, the musculature and fascia of the abdominal wall in the left upper quadrant, and the upper retroperitoneal tissues were excised en masse, with postoperative course practically as satisfactory as in Case 45. Thus it may be repeated that with adequate supportive measures there is in reality no limitation to operative procedures per se apart from the limitations imposed by well known requirements for the minimum of certain structures for physiologic function. Of greatest importance in supportive treatment is the employment of massive transfusions to obviate profound and prolonged shock.

The limits of operative surgery in dealing with intra-abdominal cancer are defined not in terms of operative procedures but in terms of the extent of the neoplastic process that may be encountered.

The patients with advanced abdominal cancer not presenting many diffuse hepatic metastases or widespread peritoneal dissemination offer a challenge to the surgeon for the fullest exploitation of his science and the

continued progress of surgery in the treatment of cancer depends upon how such problems are dealt with. The surgery of the alimentary tract was greatly advanced by the development of gastrectomy and colectomy, devised for the resections of malignant growths. Modern surgery of the brain and spinal cord was developed to a great extent under the stimulus of the problems presented by neoplasms in these organs. Thoracic surgery profited greatly by the concerted efforts of the pioneers in this field to deal with cancer of the lung and esophagus. The recent advances in surgery of the pancreas were inspired by the problem of cancer of the pancreas, an "inoperable" condition.

The high incidence of cancer has led to its consideration as a major problem in public health. Cancers of the abdominal viscera are the commonest forms in man. They account for the majority of cancer deaths. Surgery is the only effective treatment available which envisages "cure" of intra-abdominal cancer. Success in prolonged control of such growths is predicated by adequate surgical treatment in the early stages of the disease, but only the minority of patients receive laparotomy in the early stages. There is a wide field for radical surgical attack upon advanced abdominal cancer in which only palliation is envisaged, and this field is not yet being generally exploited. A defeatist attitude for these patients, based upon the premise that advanced cancer being invariably fatal, it is poor judgment to attempt prolongation of an existence which can only be unfortunate for the patient, is no longer tenable. It has been shown that a not inconsiderable percentage of a series of 100 patients received appreciable benefits from radical operations upon the "inoperable." One of the salient features of this experience has been the unpredictability of favorable results. It is believed that the results obtained justify a more radical attitude in regard to the surgical treatment of advanced intra-abdominal cancer. Increased experience with this type of surgery will afford greater numbers of patients salvaged for prolongation of life in relative comfort, patients comprising a group hitherto regarded as beyond hope of appreciable benefits from surgical therapy.

The advocacy of a more radical surgical attitude in regard to advanced abdominal cancer is not to be interpreted as justification for indiscriminate radical operations. In appreciably extending radical surgery, proper selection of patients is of utmost importance. By persistent and concerted efforts in these directions, surgeons will contribute in their field to the general advance in the cancer problem.

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